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Canadian Mining Journal, Vol. 36

JANUARY 1st 1915, TO DECEMBER 31st, 1915.

MINES PUBLISHING CO., LIMITED
263-265 Adelaide St. W.
TORONTO

INDEX

CANADIAN MINING JOURNAL, VOLUME 36

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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 1

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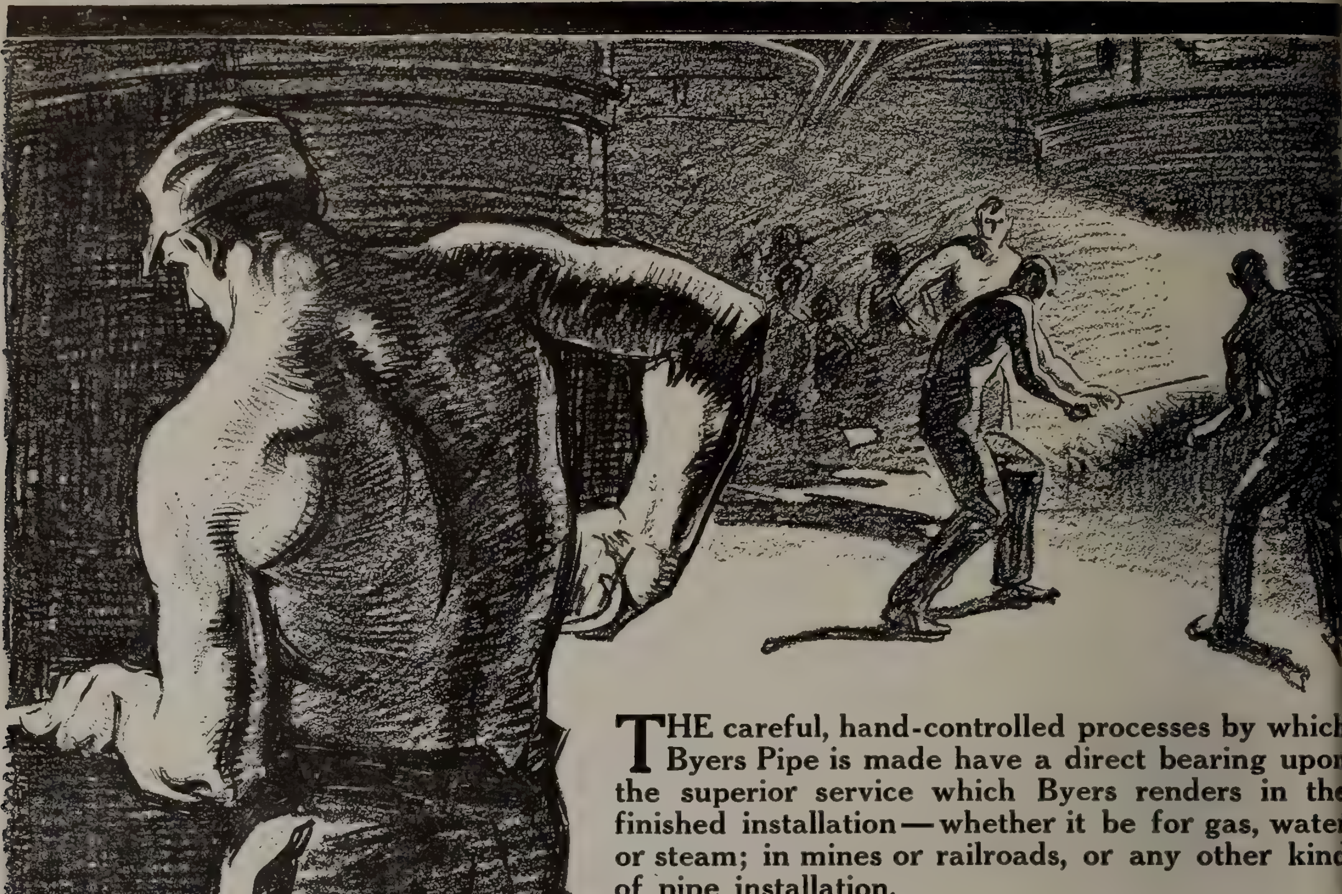

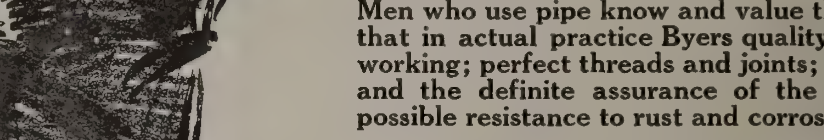
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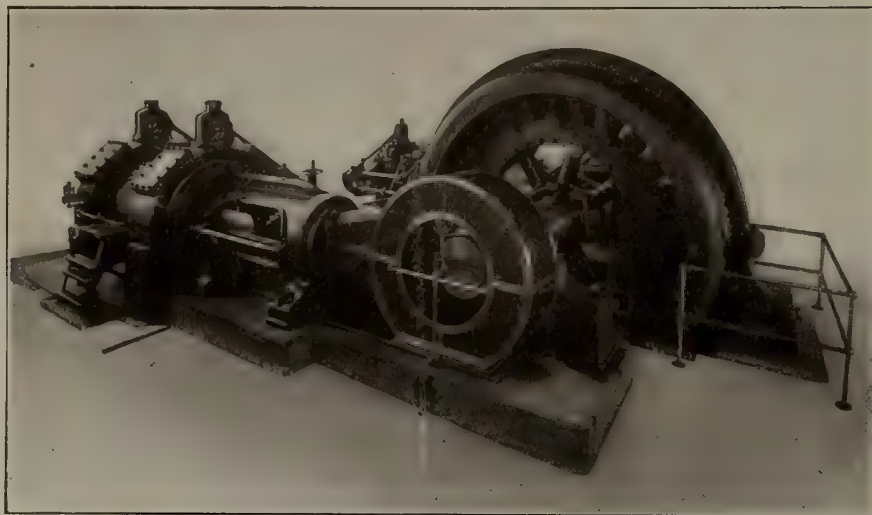

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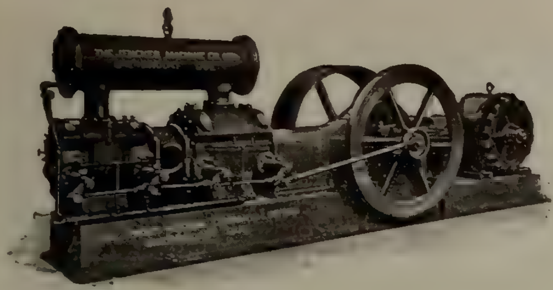

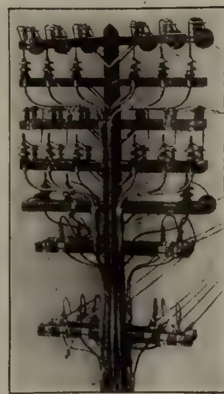

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

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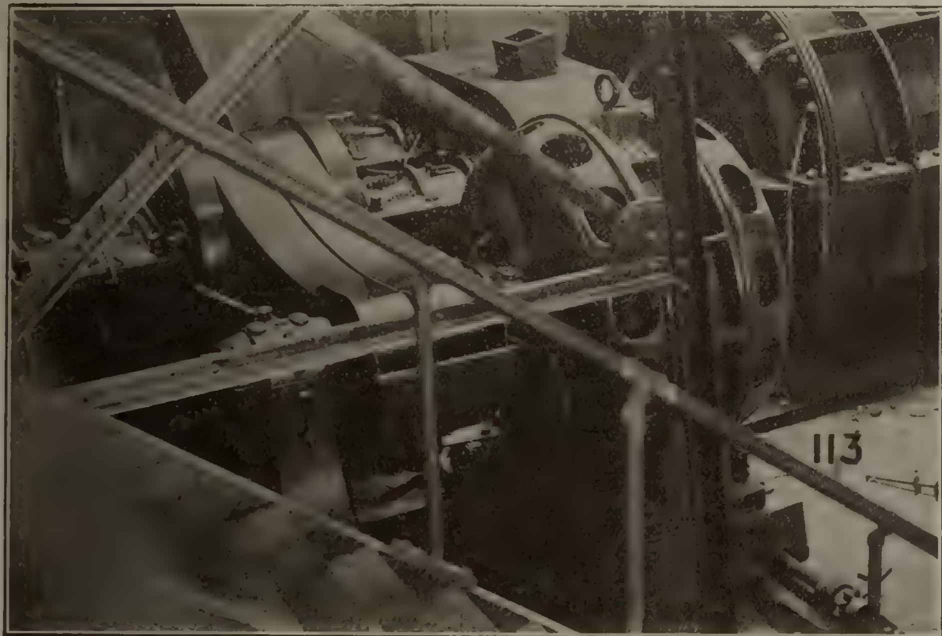
It represents a No. 9 Roots Blower in a Canadian Plant driven from a 200 H.P. Motor by means of the Renold Patent Silent Chain.



The Plate was exposed fifty seconds while the

Renold Patent Silent Chain

was transmitting 200 H.P. at 1320 feet per minute.

Note the **STEADY SMOOTH** running which means **HIGH EFFICIENCY** (98.2%) and uniform turning which means when applied to Individual Machines or Line shafts Maximum Output and highest quality of work.

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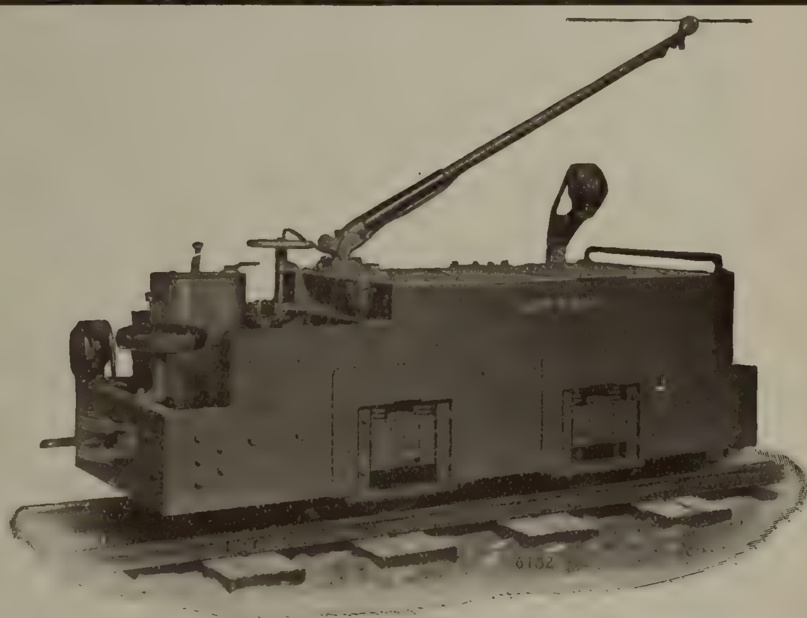

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, January 1, 1915. No. 1

The Canadian Mining Journal

With which is incorporated the

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Editor

REGINALD E. HORE

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CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

THE EXPORT OF NICKEL MATTE

The newspapers continue their tirades against the export of nickel matte, without making it clear what advantage is to be gained by such a policy. Since our last issue Mr. Monell, president of the International Nickel Co., has issued a statement that his company has not since the war began sold nickel directly or indirectly to Germany, and that no European steel makers own large interests in the company.

During the past few weeks some of the daily newspapers have insinuated that the Krupp firm owns a large share of the stock of the International Nickel Co. No authentic statement to this effect has been made; but there seems to be a desire on the part of some of the newspapers to have the Canadian public believe this to be the case. Why the editors of these papers should be so eager to frighten their readers is not evident.

A rather peculiar feature of the agitation against nickel export is that our contemporaries show utter disregard for our trade with friendly countries in their suggestions as to how Germany may be effectively cut off from the nickel market. It reminds us of the hunted ostrich that buries his head in the sand.

What countries have been most aided by the shipments of nickel matte from Canada since the war began? Our contemporaries seem to wish their readers to believe that Germany and Austria have been the fortunate ones. Nothing could be farther from the truth. What then is the object of spreading such misinformation?

Surely it cannot be attributed to patriotism. No one wishes more sincerely than we do that the enemy be prevented from obtaining war materials. Any movement to this end which seems to have merit will receive our support. But we cannot see that the newspapers have presented any information which calls for such action as they urge.

Mr. Monell's statement is of course a partisan one. As a concise statement of pertinent facts it contrasts very favorably with the newspaper editorials. It is, however, rather too concise. That, however, is a matter for the Government. From Mr. Monell's statement we assume that the Government is fully informed.

Since the above paragraphs were written the Dominion Government has issued the following memorandum:

"Various criticisms have appeared in the press with regard to the export of nickel matte from Canada to the United States.

"The whole subject has been under careful consideration and investigation by the Government of Canada since the commencement of the war, and they have been in frequent communication with the British Government as to the precautions which should be taken to prevent export to Germany.

"The books of the company in New York are inspected at short intervals by a thoroughly trained and experienced accountant, who goes into all exports most thoroughly and reports to the Canadian Government.

"In addition to this, by an arrangement between the company and his Majesty's Government, certain control is exercised in London through the company's British representatives. The company is not under German control, but is controlled altogether in the United States, where the vast majority of its stock is held. There may be a few German shareholders, but the proportion is insignificant, and there are no German directors.

"The steps taken by the Government of Canada have the entire approval and sanction of the British Government, who express themselves as entirely satisfied with the precautions that have been taken.

"It must be borne in mind that nickel exported from Canada to the United States is used in a large number of industries in that country, and prohibition of the export, except for the most urgent reasons, would be undesirable, as it would produce great business disturbance in a country whose sympathies are very strongly with the cause of the Allies.

"Moreover, the Government is informed that there is an output of nickel in Norway controlled by German interests which could furnish a sufficient supply for German requirements during the present war."

We are thus assured that the British Government is satisfied with the precautions taken by the Dominion Government. We are pleased to have this official assurance. Taken together with Mr. Monell's statement, it confirms our belief that the advocates of prohibition of export of nickel matte are barking up the wrong tree.

We also beg to tender to the Dominion Government our congratulations for the action taken in the matter. Several thousand people in Northern Ontario depend directly or indirectly for their livelihood on the nickel industry. The Government has found it possible to guard the Empire's interests without ruining the industry by adopting such measures as our contemporaries advocate.

MINE INSPECTION

It is very often asserted that mines in Ontario are not inspected by Government officials frequently enough. It is claimed that every mine should be inspected at least once a week, and that at present there are lapses of months at some mines.

There can be no gainsaying these statements. It is generally recognized that no mine can be examined too frequently. Where mining is being actively carried on, conditions are changed by every blast. Obviously, however, the Government official cannot be expected to examine the mine after each shot is fired.

In the opinion of many the official inspection is chiefly useful in preventing those in charge from becoming careless through familiarity with danger, and in offering suggestions concerning safety devices and rules. The question then arises, how often should visits be made in order to keep the mining captains and shift bosses alert to the danger. To the miner, examination of the working places is a part of the daily routine. The mine captain in his rounds has a watchful eye for defects in shafts, haulage ways, etc. He finds here a gate left open and there a loose block in the roof. In characteristic language he reprimands those to blame—if he can place the blame. But the mine captain's chief business is getting out the ore. Having many things to think about he may neglect to enforce safety rules, even when the breaking of them does not escape his attention. At such times the visit of a Government inspector is liable to rouse him to his duties. No mining captain likes to have his mine inspected when it is in bad shape. Hence there is something to be said in favor of visits at irregular intervals, provided the intervals be not too long.

Such inspection cannot, however, be considered to take the place of the daily inspection, which should be made by an employee of the company. In the case of large mines an inspector should be attached to the staff. The case of small companies is not so easily dealt with. The inspector must have other duties in order to earn his salary. Managers of small mines therefore would welcome some provision for inspection at very frequent intervals by an inspector delegated by the Government to a small group of mines.

CANADIAN MINING INSTITUTE ANNUAL MEETING

The seventeenth annual meeting of the Canadian Mining Institute will be held in Toronto in March, 1915. Preliminary arrangements indicate that the meeting will be a successful one in spite of the fact that many members are in Europe serving the Empire, and others are forced by a sense of economy to deny themselves the pleasure of attending the meeting this year.

Under the circumstances it is not unlikely that plans for entertainment will be less pretentious than usual, and that a little more time will be given to business. The character of the meeting will naturally depend very largely on the progress made by the Allies in the next few months.

It is expected that the business session will prove unusually interesting, on account of an important suggested change in the by-laws. It is held by members in some provinces that they have not a fair representation on the council. Certainly the list of members does

not indicate a fair distribution. Look over your list.

Secretary Mortimer-Lamb advises us that several papers have been promised and that they afford good topics for discussion. It is to be hoped that more opportunity than usual will be given for discussion. The printing of papers some time before the meeting should enable members to present their views at the meeting. Criticism of papers presented is helpful and should be freely participated in.

THE WORKMEN'S COMPENSATION ACT

The Workmen's Compensation Act goes into effect Jan. 1, 1915. Circulars sent out by the Commisison convey the information that the rate for mining companies will be three per cent. of the pay roll. Surface and underground workers are rated alike.

It is not expected that all directors of mining companies will be greatly pleased at this new tax on their income. Some, however, probably most of those in charge of large companies, will welcome the Act, as it helps to systematize the business.

Criticism as to the provisions of the Act may be expected to follow its enforcement. It is not unlikely that weak parts will soon be found and remedied. Until it has been in operation for some time, however, it will be difficult to weigh the merits of some of the objections which are being raised.

One feature which is not very pleasing to those who are making unusual efforts to avoid accidents in mines, is the lack of encouragement to be found in the provisions of the Act. Companies providing safety appliances and enforcing safety rules pay at the same rate as those conducting operations carelessly.

BRITISH COLUMBIA IN 1914

As the year draws to its close it is possible to make a rough estimate of the value of the mineral production of British Columbia during 1914. With only very incomplete information as a guide, it seems probable that a total value of between $25,000,000 and $26,000,000 may be estimated. It may be the latter amount will be slightly exceeded, but at this writing it seems better to place the total at somewhere about $25,900,000. Of this amount, approximate proportions are: Metalliferous minerals $15,100,000, coal and coke $7,800,000, and miscellaneous products $3,000,000. There seems to have been small increases in gold and zinc, but silver, lead, copper, coal and coke, and building stone and other structural materials included under the head of "miscellaneous" appear to show lower totals than those for 1913. As the total for the latter year was $30,296,398, a decrease of approximately $4,354,000 is estimated. Possibly the position will be somewhat better when the revised returns come in; meanwhile the foregoing statement may be taken as giving in a general way a fair idea of the total value of the year's mineral production.—E. J.

REFINING NICKEL IN CANADA

In this issue we publish a letter from Mr. R. W. Leonard, president of the Coniagas Reduction Co., on the subject of refining nickel in Canada. Mr. Leonard seems to be of the opinion, after careful study of the matter and consultation with his technical staff, that a nickel refinery could be economically established in Canada. He intimates, however, that the two companies now operating would have to sacrifice a few million dollars now invested in the United States and Wales.

The establishment of a nickel refinery in Canada is, as we have asserted before, greatly to be desired. We are pleased to have Mr. Leonard's opinion that the project is a feasible one, if we neglect consideration of present investments in plants abroad. Possibly the plants now in operation could in time be put to other uses and not become a total loss if Candian plants were established.

CORRESPONDENCE

RE REFINING NICKEL IN CANADA

To the Editor of the Canadian Mining Journal:

Sir,—The editorial on page 790, Canadian Mining Journal Dec. 15 last, answers an article in the Toronto Star re the above subject, which was one of a number of articles recently appearing in the public press in Canada in favor of and against export of nickel from Canada, refining of nickel in Canada, etc.

Your editorial states that an experienced company might erect a plant for refining nickel in Canada in a few months. You are right. You cannot guess how long it would take to "establish" such a plant, and suppose that what the Toronto Star means is a plant that can be economically operated.

I have gone into this subject in a general way with our staff, and reach the following conclusions, which, without quoting actual figures, prices, etc., will give a fair idea of this much discussed subject.

If one of the established companies operating nickel refineries in Wales and New Jersey wanted to, they could "establish" and economically operate such a plant from date of erection plus a short "tuning up" period, provided they shifted skilled superintendents and foremen from existing works.

The Welsh works of the Mond Company use for raw materials: Bessemer matte (made in Canada), coal, coke, sulphuric acid, power (small), labor. Lastly and most important, the Mond refinery has had the wonderful genius and engineering skill of the late Dr. Ludwig Mond, and of his technical staff, of which Dr. Carl Langer was most instrumental in perfecting the nickel process.

The relative prices of coal, coke and acid in Clydach and certain points on the great lakes can be ascertained. Surely the freight differences on matte would offset considerable differences in fuel costs.

The labor question has never prevented a company from building and "establishing" works for all sorts of purposes where natural resources invite exploitation. It is premised that the technical skill is supplied from existing establishments.

The Orford Company's works in New Jersey use:—Bessemer matte (made in Canada), coal, coke, saltcake, nitercake, muriatic acid (trifling), sulphuric acid (small), firebricks.

It is doubtful if this company would have to pay more for saltcake at a Canadian point on Lake Erie than it does now.

Comparisons of coal, coke and firebrick can easily be had for Constable Hook and any Canadian point. If for any reason saltcake could not be bought cheaply at lake ports, the raw materials salt and pyrites are abundant in Ontario, and a big Hargreaves saltcake and hydrochloric acid works would neither cost very much to build nor require too much technical skill to operate. A good use for the hydrochloric acid could be found in connection with the nickel industry.

The works at Kristianssand, Norway, use a process, the use of which in Canada has been acquired by a company operating in the Sudbury District. Their raw materials are: Bessemer matte (from Evje), coal, coke, power (large), sulphuric acid.

This works is a shining example of what may be done in a country blessed with nickel ores and a determination to work them up at home. They import their coal and coke at a cost that would make Ontario price

THE LATE LUDWIG MOND

look cheap, and from ores much poorer than those of Sudbury ore are turning out about 1,000 tons annually of electrolytic nickel of most excellent quality.

Factors which were of controlling importance in 1889, 1890 and 1895, have been eliminated since. Other factors which now appear to interfere, are all of a character which may be cancelled if the powers that be shall so will.

Nickel if refined in Canada can be sold to steel works or any other purchaser in Canada or elsewhere. Because we make lots of flour in Canada, it is not necessary that we make it all into buns in this fair land. There is no special plant required outside of what may be found at Sydney, Hamilton or the Soo for making nickel steel. If these works had a demand for bridge stuff, rails or bars of nickel steel there are no technical reasons why they could not make them now.

In the matter of technical skill it is to be noted that the Orford Copper Company which developed the process used by the International Nickel Company at their works at Constable Hook, New Jersey, originated at Orford Mountain Mine in the Eastern Townships, Province of Quebec, and it was long recognized around those New Jersey works that one had to talk Canadian to get on with the majority of the technical staff.

A great majority of the superintendents, managers, etc., of the great copper mines and smelters of the United States, which country produces 60 per cent. of the world's copper, are Canadians.

There absolutely is no present reason why any of the existing nickel refiners could not "establish" their works in Canada if they are prepared to sacrifice the few million dollars invested in Wales and New Jersey, and move their technical men to Canada. It is doubtful if the difference in operating costs would be perceptible in the selling price of their products.

Yours, etc.,

R. W. LEONARD.

St. Catharines, Dec. 28, 1914.

B. C. MINERAL PRODUCTION IN 1914

To the Editor of the Canadian Mining Journal:

Sir,—From the "president's address," included in the annual report of the Bank of Montreal, printed in western Canadian newspapers, I make the following excerpt from the information given under the sub-head "Province of British Columbia": It is estimated that the total mineral production for 1914 will be 75 per cent. of last year. Consequent upon the inactivity of the smelters, the collieries also are not doing so well, and the output of coal has been greatly diminished."

May I venture the opinion that the president was not fully informed or, perhaps, that it was necessary for bank officials to make an estimate too early to allow of the information now obtainable being available. As a result of my own enquiries and calculations, in connection with the preparation of my annual review of mining in British Columbia, I have reached the conclusion, of course with the production of the last two months of the year largely estimated, that the total value of the mineral production of British Columbia for 1914 will be fully $25,700,000. As the total given in the Provincial official records for last year was $30,-296,398, it follows that the amount I have estimated for the year now closing is approximately 85 per cent. of that on record as the value of the mineral production in 1913.

E. JACOBS.

Victoria, B.C., Dec. 15, 1914.

THE COPPER PRODUCERS' ASSOCIATION.

Officially, nothing has been done toward dissolving the Copper Producers' Association. Individually, some of the copper producers would prefer that the activities of the association cease, particularly as concerns the monthly statements of stocks in refiners' hands. None of these figures have been compiled since those issued in July covering June operations. In fact, members have not even been called upon to submit their individual statistics. Their monthly assessment for expenses has continued, however.

No salaries are paid except to the secretary, L. C. Graton, who quit the United States Geological Survey for this $6,000 position. His time of late has not been given entirely to the association, for he has held a professor's chair at Harvard for the past two years, leaving the office routine in charge of an assistant.

WHO'S WHO IN MINING AND METALLURGY.

The 1915 edition of Mr. George Safford's book "Who's Who in Mining and Metallurgy," is now in preparation. Mining engineers and metallurgists are urged to send in their records as soon as possible to Mr. Safford at 18 Eldon St.. London, E.C.

THE BUSINESS ETHICS OF THE ENGINEER*

By G. G. S. Lindsey.

Addressing many who have adorned and honored the profession of Engineering, I would be unwilling to formulate my opinions on the nature of the moral agent as an intelligent and free being possessed of a conscience, were I not sure that many of my younger hearers are glad to be told what are the points of the compass by which those whose course they are anxious to follow, steer; a course always true.

"True as the needle to the pole,
Or as the dial to the sun."

I am not a student of the science of resolving cases of doubtful propriety, but I have had many opportunities of observing the practices of Mining Engineers, and, though not a qualified technical engineer myself, know fairly well what are the ideals of the best of them.

Professional Ethics differ in no respect from some of those promulgated on Mount Sinai. No human rules have as yet been laid down which are binding and which have been accepted as the test to which all mining engineers must subscribe as the standards of their profession. And because there is no law, the greater is the moral obligation on the Engineer to fix high standards and voluntarily to live up to them on all occasions. That legal sanctions will come, perhaps soon, prescribing what is right in some matters now left to conscience, I have no doubt. Among the fiirst of them will be those which provide that whenever the public is asked to subscribe for mining stock it must bear the hall-mark of a qualified engineer.

The constituency of the Mining Engineer is the mining community, and while his endeavor is always in the direction of elevating the industry he serves to as high a commercial plane as is possible, yet it is true that the constituency to which he devotes his life's work is one in which the speculator largely predominates, and necessarily so. That the public will speculate is no fault of his. The community should welcome the man who on chance, puts his money into what becomes a fruitful mine.

It has been said that "mining is, was and will be to the end of time a sane speculation or a silly gamble, but never an investment; the element of risk is never eliminated and any statement to that effect, as regards a particular mine, is made by a charlatan or a fool." To part of this statement anyone will subscribe. The most serious objection made to it, was that it was too frank an admission of the truth. But as successful mining is based on the application of Science to that industry the nearer we get to the truth the less danger we run and the closer we come to solution of the mining problem, how to dig ore and make it pay.

Of the two capacities in which the Mining Engineer may be engaged whether as mine valuator, or to advise on development, equipment and operation of mines and metallurgical works, the former alone calls for attention; because in connection with the other what were formerly matters of conscience, such as taking what was called the "customary commission," a percentage paid on the price of machinery and supplies recommended by him, are now penalized by statute.

As a mine valuator, the engineer will find his duties are divisible into two sets, those business methods concerning which a bargain can be reached satisfactory to all concerned, consistent with thorough and honest work; and those business ethics in which the exercise of his moral faculties is called into play. To the latter only I intend to direct your attention.

When a client selects an engineer, such reputation as the engineer has gained is assumed to have a market value and the price is offered him on that basis. Once engaged, the engineer's fiduciary relation, outside of his duty to himself, is two fold, he is trustee for his employer as well as such of the investing public as may be asked on the strength of his report to invest in the shares of the company for whom it is made. The engineer should therefore never make a report for a contingent fee, a fee in stock, which depends for its value upon his report in creating confidence in the public mind. Such conditions cannot but influence the judgment of the maker of the report.

When outfitting, the question comes up, what part of the engineer's equipment can be charged to the client. The engineer is assumed to be equipped and outfitted for the work pertaining to mine examination. A charge should only be made for such equipment as is either consumed in the work or returned to the employer. If special equipment is needed for the particular task the client must provide it.

On the journey the engineer is entitled to first class passages on trains and boats and to the best accommodation at hotels. But the expense account is not one which admits of personal gain. It is always desirable for him to travel as a gentleman and not appear cheap in any way. But to travel by one class and charge for a higher is petty larceny. Opinions differ as to the spending of money on entertainment for the purpose of obtaining pertinent information, and although the engineer is sent to secure information and trusted to use his discretion, it is better not to do this at the expense of the client unless it is so agreed.

The engineer's examination may indicate that the shares should be worth more than they are selling for on the market and he asks himself, "Is it fair to buy the company's shares before my report is turned in, or, if not, is it right to do so afterwards?" This means buying shares on information gained at the client's expense. To use his broker before advising his client of his conclusions would be unpardonable. The man of capital does not employ the engineer with the idea that a business trust is to be turned into a personal coup. As was said of the contingent fee, personal interest constitutes a bias in the engineer's opinion. An engineer cannot mix up in a stock deal at the time of reporting without directly laying himself open to the imputation of dishonesty.

It is better too for the engineer not to buy shares after his report is in. It may be that his buying or selling of shares would work a distinct injury to his clients as he may not be informed as to the object of his employment. It is better, on the whole, to leave the stock market entirely alone when engaged in confidential work of this nature.

But it may be asked: should an engineer be precluded from buying a good stock because his examination and personal knowledge shows it to be good? Must he always buy stock in something he knows nothing about personally? It is not an excellent way of showing his confidence in his own judgment, to buy the shares?

*A speech delivered at the annual dinner of the Engineering Society, School of Mining, Kingston, Dec. 15, 1914.

The confidential relation of engineer and client does not end with turning in the report, and a conscientious man will therefore neither buy nor sell shares. If it be done with the knowledge and consent of the employer, there is less objection. But the unwisdom of taking shares even under these conditions is well illustrated by what has actually happened. The shares go up, can the engineer sell when he thinks they have gone high enough without affecting his employer's position?

In the case of Yukon Gold, while the owner was making a market price for the shares, the engineer who had made the report was selling. The engineer's information on which he sold belonged to his client, and his being a seller must affect the market. Whatever the propriety of the owner's course, the engineer was using information he had been paid to give his client to the client's disadvantage.

In any case such shares are dangerous to the young engineer who has not learned that stock manipulation is one thing and the value of stock based on the merits of the mine is another thing and not necessarily in accord. The stimulus of a share gamble is the most insidious lure he faces in the early stages of his career. A good authority has said "it has spoilt many fine fellows, is has ruined twenty times as many good engineers as it has enriched."

Being in a district, it is not legitimate for the engineer to take advantage of his presence there to examine and perhaps option mining properties for himself, or to examine and report on properties for others. Even though no time is lost that properly belongs to his employer?

It certainly is not legitimate to take advantage of his presence in a district to report on properties for other parties in the absence of specific agreement to that effect. Apart from such questions as possible competition, he is there on his client's money. It is proper and advisable to see as much of a district as possible but not to use the information for personal gain; if the engineer's examination shows that the properties in the district are of value the information belongs first to his client.

The acquisition of property or options over property on his own behalf would be liable to severe criticism, and place the engineer in a very false position, even if acting in perfect good faith. An engineer returning from the Portland Canal where he has made an examination, finds himself at Prince Rupert and no boat due for a week. He takes a trip to a nearby district, examines and options a prospect, paying all expenses himself and returns in time for the boat. His clients have lost nothing, but as they have paid the expense of his trip to Prince Rupert they should have the opportunity to take the prospect.

If after full disclosure and report the client consents to his keeping any part of what he has got then it is quite proper to do so.

When the engineer has returned home he is concerned to know if he may properly publish in technical periodicals a description of the district visited, giving general information of the conditions obtaining there; the topographical and geological features and conclusions concerning the possibilites of successful mining. This is a question for his client, not for himself. It is in all cases proper to ask permission to publish articles, the material for which is gathered at the expense of another. All general information on any district has an important bearing on any investment in that district. This information is the exclusive property of the client until such time as it no longer concerns his interests. When he permits it, is soon enough to give it to the public.

The answer the engineer is to make to the questions submitted to him necessarily depends on the form of the questions. The man who desires a report wants to know whether the information obtainable justifies his putting up the money that is asked. The demand is for something more than a judgment which hedges. The responsibility should be faced if a judgment is required on the commercial question involved.

If an opinion can be expressed in one word, he should use it, but if he can't he should say so. He is entitled to say he does "not know," when the conditions are such as to leave the matter in doubt. He may condemn a substantially good mine being unable to get sufficient information to warrant a favorable report, and will be right in doing so. The positive answer should be given only when all the conditions justify it. If there are any reasonable doubts, they should be expressed, leaving the client to take the risk.

Every form of disguised advertising is to be avoided. This is an age of commentary, but many of the reviews of professional work to be found in our literature today on the subject of mining engineering have for their purpose only the aggrandizement of the reviewer. This serves no good purpose and stamps the man. It fails in its object—not a very noble one—to bring the writer into prominence at the expense of the more proficient. An engineer is entitled to just such standing as his merits justify, and he is unworthy who seeks notoriety through the medium of criticism of honest and creditable work.

Adherence to such a code of honor as I have endeavored to outline should bring success to the young engineer. A fine sensitiveness is rarely appreciated at its value by those who employ professional services, and confident assurance often commands respect where modest merit is sometimes distrusted.

You would achieve greatness? We are told.

> "That man is great and he alone
> Who serves a greatness not his own
> For neither praise nor pelf:
> Content to know and be unknown,
> Whole in himself."

Yet I would not have you disregard the pursuit of fame, nor indeed of riches. To the professional man "fame is the shade of immortality." I would rather have you say with King Hal,

> "By jove I am not covetous for gold;
> * * * * * * * *
> But if it be a sin to covet honor,
> I am the most offending soul alive."

Covet honor! Find it and you will be rich. Gold will follow. It is the reputation that commands the fee.

MINE EXPLOSION AT STELLARTON.

New Glasgow, N.S., Dec. 20.—Deputy Inspector of Mines for the Province of Nova Scotia Thomas Blackwood, and James Brown, Superintendent of the Acadia Co. mine (the Allan Shaft at Stellarton), both lost their lives this morning in that mine.

About 9.30 a miniature explosion occurred there and later these two officials, accompanied by Neil McLean, overman, descended into the mine to discover the cause of the explosion.

On their failure to return a rescue party went down and found all three helpless, having encountered a quantity of gas, and lost their way.

McLean responded to the efforts to resuscitate him but both Blackwood and Brown were found to be dead. Deputy Inspector Blackwood is a well-known figure in Nova Scotia mining circles, and has held the position for several years.

THE STAKING OUT OF WORKING PERMITS IN ONTARIO

By J. A. McDonald.

It is important to know that before a patent for a mineral claim is issued by the Department at Toronto, the surveyor has to file triplicate plans of the claim, that it may be laid down in the general office plans. Before the patent issues for a mining claim, the Minister must be satisfied that the claim is recorded and certificates of the full performance of the working conditions filed. Placer claims are treated, in Ontario, just the same as ordinary mining claims.

An Ontario land surveyor must do the work of surveying the claim. A Dominion land surveyor cannot, legally, perform the work, while an Ontario land surveyor cannot, legally, survey mining claims in the western provinces nor in the Yukon, not but one surveyor can do the work as well as another, yet, owing to the lack of reciprocity among surveyors, each group is restricted to a limited field.

To meet cases where a discovery of valuable mineral cannot readily be made upon the lands, provision is made for obtaining what are called working permits. By fulfilling certain provisions of the Ontario Mining Act any person may obtain a working permit for the purpose of prospecting for minerals, the exclusive possession of an area of land open to prospecting and staking out. The chief duty to be performed by the licensee is staking the corners and marking the boundaries of such area, and placing numbers and particulars upon the posts in the same manner, so far as possible, as required respecting mining claims, omitting "discovery post," etc., but the words "working permit applied for" shall be written on No. 1 post, and each post must be notched with three rings of notches not less than one-quarter in. deep and not less than 2 in. apart, beginning about 2 in. from the top of the post.

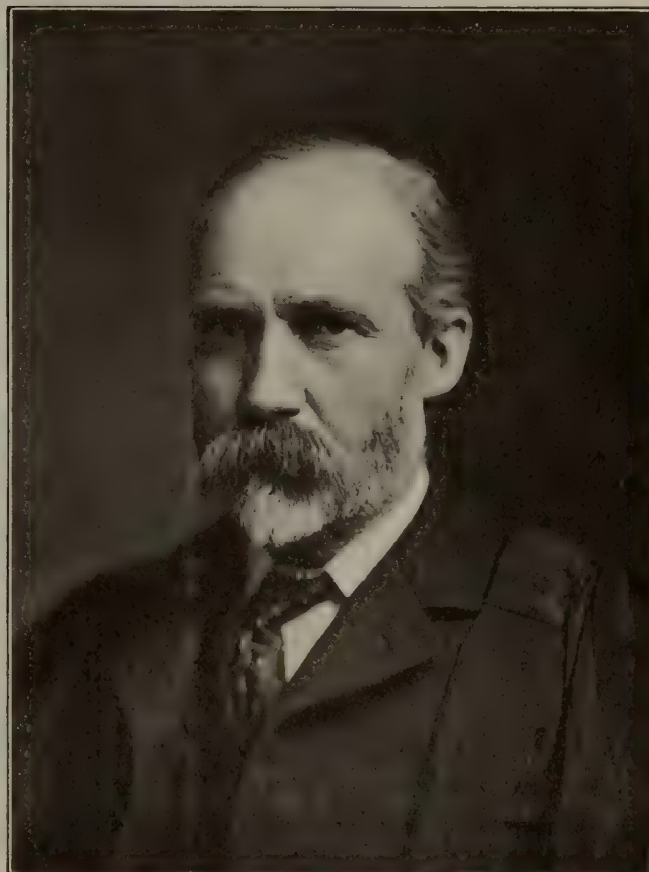
It is further required that within 15 days after the staking, an application, in duplicate, accompanied by an affidavit stating the name of the licensee on whose behalf the application is made, locality of the area, and such other information as will enable the recorder to lay down the area in his office map, and the time when the area was staked out. Where, however, the area is more than 10 miles from the Recorder's, an additional day is allowed for each ten additional miles.

The Recorder will then issue a certificate, which certificate is securely affixed to post No. 1, within three days from the granting thereof. In cases where the surface rights have been previously granted, leased or sold, compensation for damages arising from such prospecting must be made. Upon compliance with these necessary requirements and the payment of the prescribed fee the applicant can, after sixty days, and within seventy, of the staking out of the area, procure from the recorder a working permit, which shall be good for six months from the date of issue.

Until a working permit has been granted and a notice affixed to No. 1 post, the area included in the application is subject to prospecting and staking out as a mining claim by any licensee, but thereafter during the continuance of the working permit, or its renewal, the holder has the exclusive right to prospect and stake out on that area.

The holder of such a claim must begin working within two weeks of the granting of the permit, and perform upon the area such work as searching for minerals by the sinking of shafts or pits, digging trenches, making crosscuts, boring or operations of like kind to the extent of five days of eight hours per day in each week," provided the work can be performed in less than six months. But no work is required to be done between Nov. 16 and April 15, a renewal for six months can be obtained. If the holder of a working permit makes a discovery of valuable mineral in a place upon the area of land included therein, he may stake out and record a mining claim thereon in the ordinary way.

The fee for issuing a working permit is $5, and for a renewal $1.



A. P. COLEMAN, Ph.D.
Professor of Geology, University of Toronto, who has been elected President of the Geological Society of America

CANADIAN WESTERN NATURAL GAS CO.

Gross earnings of Canadian Western Natural Gas, Light, Heat & Power for the fiscal year ended September 30, 1914, were $951,288, an increase of $327,005, or more than 52 per cent. over the preceding year.

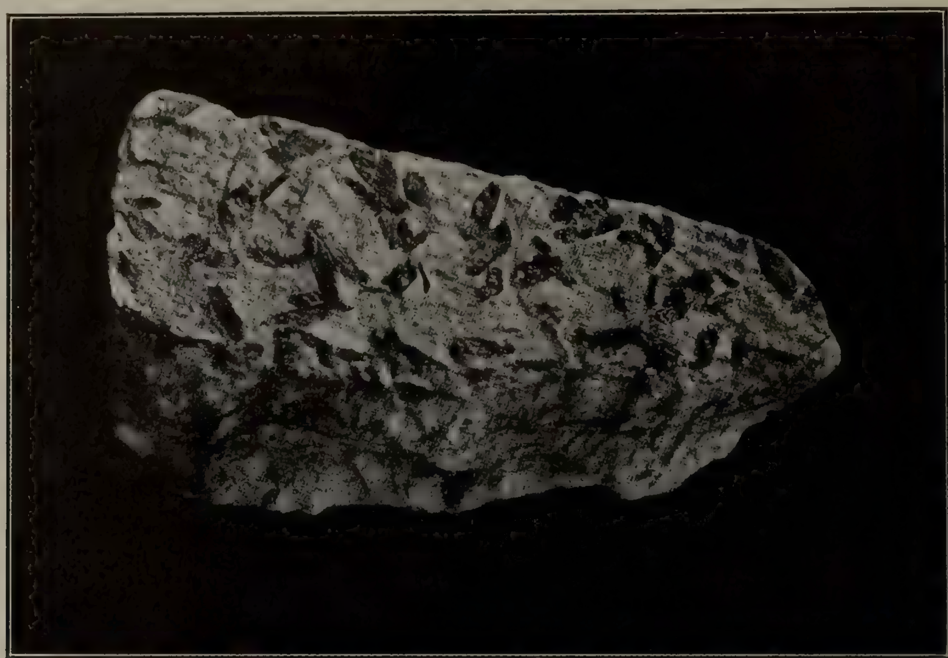
Canadian Western Natural Gas supplies gas through a number of subsidiary corporations to many communities in western Canada. The large gains were made in the early months of the fiscal year. October, 1913, reported an increase of $52,000 over October, 1912, and February, 1914, an increase of $67,000 over February, 1913. In May, 1914, the gain dropped to $4,700 and July showed a decrease of $1,972, while August made a decrease of $3,708. September, the final month of the fiscal year, did better, making a gain of $2,840.

The large increases made in the earlier months of the year were due to the starting of operations early in 1913 in new distributing territory and not to gains made on old business. It is probable that for the current fiscal period the increase will be much smaller than for last year.

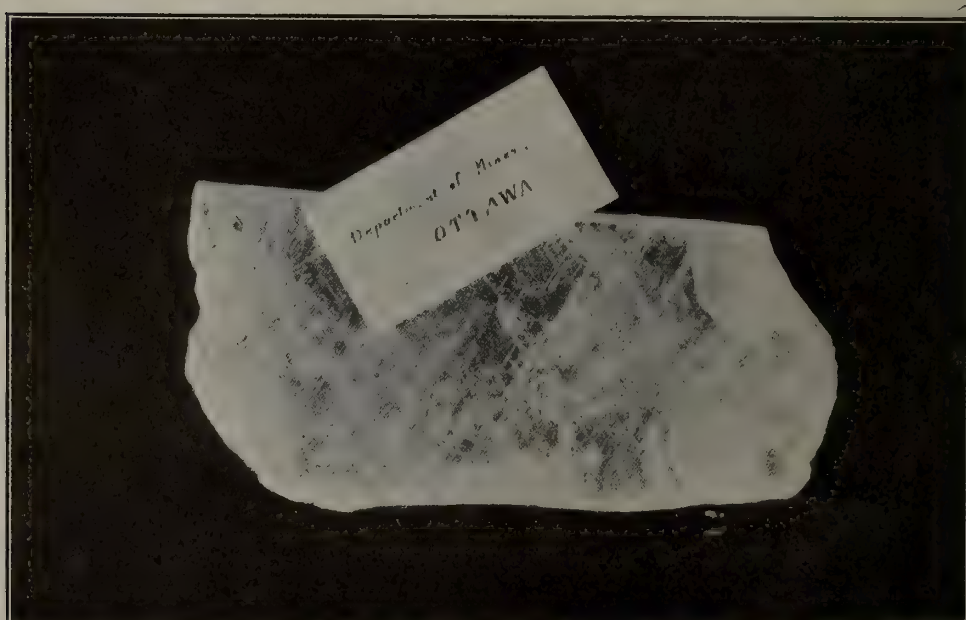
GYPSUM IN CANADA

The Mines Branch has just published an excellent treatise on Gypsum in Canada, its occurrence, exploitation and technology. Mr. L. H. Cole is the author.

The gypsum industry of Canada is one of the more important non-metallic mineral industries of the country, and one of which very little descriptive literature is available. The Mines Branch of the Department of Mines, in 1911, issued a report on the gypsum deposits of the Maritime Provinces. Previous to this, the only descriptions of the gypsums of Canada were to be found as incidental references in the reports of the Geological Survey; the Statistical Division of the Mines Branch, Department of Mines, and the various provincial Bureaus of Mines. The present report deals with the gypsum deposits of the whole of Canada. The field work was carried on during the summers of 1911 and 1912, and visits were paid only to those districts where actual operations are being carried on, or which are near enough to transportation and large markets to give promise of being opened up in the near future.



Gypsum with embedded selenite crystals

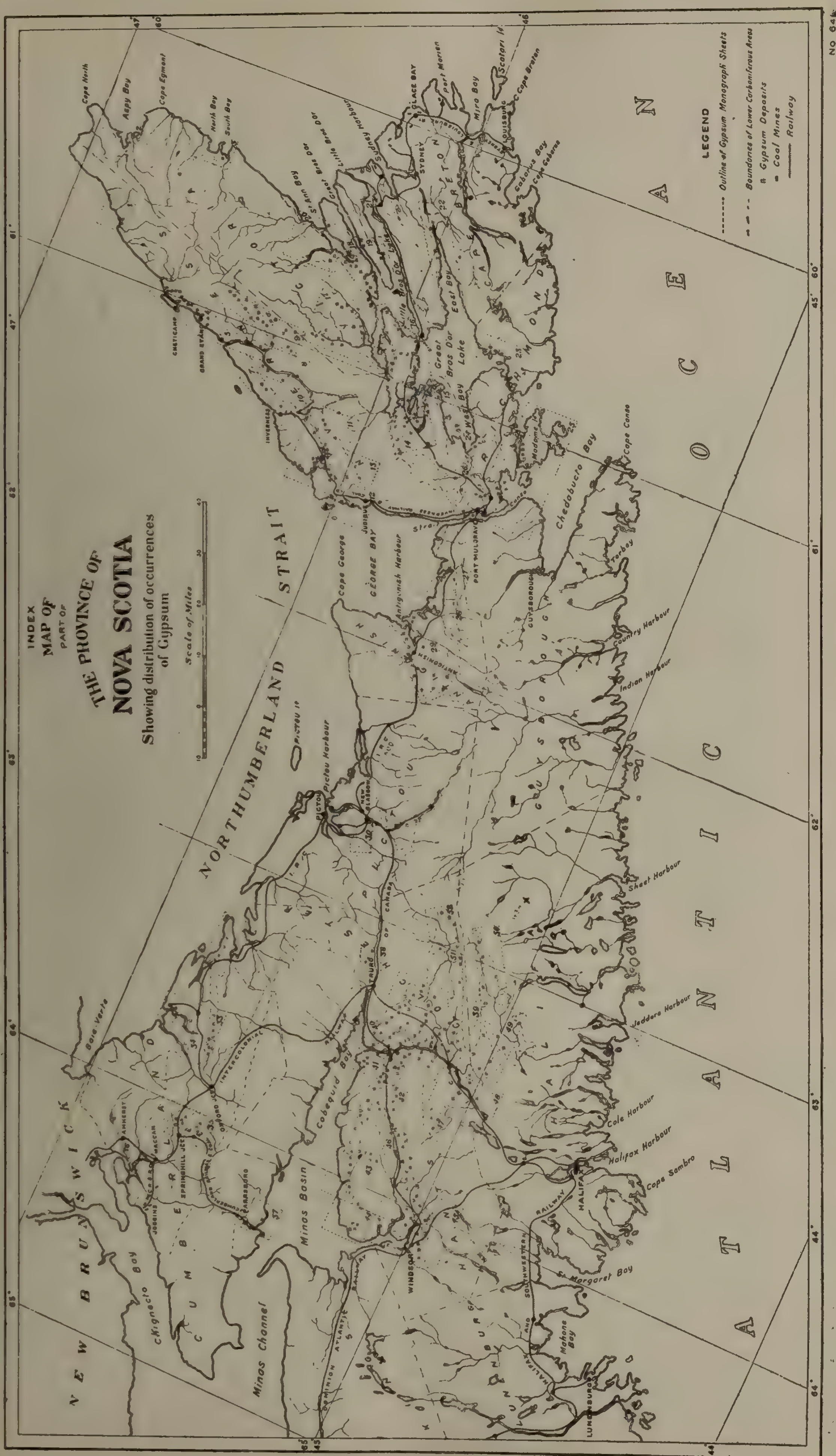


Transparent Selenite

Special attention has been paid to the mining and quarrying of the material, and its manipulation and manufacture after it reaches the mills. An endeavor has been made to give some idea of the present condition of the industry, and also of the prospects for future trade.

The report is divided into three parts.

Part 1 deals with general matters relating to gypsum, its properties, theories of origin, and a brief review of the gypsum statistics of Canada, with a few remarks on the trade conditions.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Part 2 covers the detailed descriptions of the different occurrences in Canada, and of the plants in operation.

Part 3 takes up the technology, and uses of the mineral.

During the year 1912 nineteen companies were engaged in the quarrying or mining of gypsum in Canada. Nine of these companies produced crude gypsum only, most of which was exported to the United States for manufacture into the finer grades of plaster of Paris. During the early part of 1911 there were six calcining plants in Canada, operating, in all, thirteen kettles. At the close of the same year two new plants started, and two companies, already operating, have enlarged their plants, so that eighteen kettles are now running. One plant is using Cummer kettles as preliminary driers, preparatory to calcining in kettles, and two plants are using other types of driers. In three cases the gypsum was obtained from mines and the rest from quarries. The material, in all cases but one, was gypsum rock, either white or grey. The single exception was the small production from British Columbia, which was a high grade gypsum earth.

Cove gypsum quarry, Cheverie, Hants Co., N.S.

The gypsum industry of Canada consists, chiefly, in quarrying the crude gypsum, and in shipping it in that state to the United States. There it is calcined, and, in part, shipped back to Canada as a finished product. The industry on the whole is gradually increasing, but, as regards the extent to which calcining is at present carried on in Canada, there is still ample opportunity for growth. Even with the mills already operating at their full capacity, there is still considerable quantity of the finished product being imported from the United States.

It is only recently that any endeavor has been made to place the advantages of the hard wall plasters before the public; yet, by demonstrating the method of application of these plasters, and by means of advertising pamphlets describing their adaptability for different uses, the producers could readily increase the volume of their sales. Concerted effort along this line by all the producers manufacturing in Canada would greatly benefit the industry.

CANADIAN MINING INSTITUTE.

A regular meeting of the Toronto branch of the Canadian Mining Institute was held on Saturday, Dec. 19. Among the guests were O. E. LeRoy and E. Lindeman, of Ottawa; J. Donnelly, of Kingston; E. T. Corkill, of Copper Cliff, and G. Galt, who is on his way to South America.

Mr. LeRoy and Mr. Lindeman gave some account of the work of the committee on the Iron Industry. Mr. LeRoy stated that the committee at present is gathering information for the Government and expects to undertake some investigations in the spring. He asked that the Institute criticize the work of the Department, believing that criticism is helpful.

Mr. Donnelly spoke of the mining activity near Kingston stating that feldspar shipments are large and that there are prospects of the establishment of a potash plant.

Mr. Corkill told of a visit to the Exposition of Safety and Sanitation at New York and called attention to the excellent safety work being done by the New Jersey Zinc Co. He spoke also on the provisions of the Workmen's Compensation Act which goes into force this year. A. J. Young, Col. Hay, Frank Loring, T. F. Sutherland, D. A. Dunlap, E. T. Corkill, W. E. Segsworth, H. E. T. Haultain and James McEvoy, took part in a discussion on the Compensation Act.

The next meeting will be held on Jan. 9, 1915.

DEEP METAL MINE.

The St .John del Rey mine is now 5387 ft. below adit and 5711 ft. in total vertical depth, so that it is the deepest metal mine in the world. The deepest workings in the Tamarack mine in Michigan are about 5430 ft. below the surface.

THE PEACE RIVER COUNTRY

By Martin J. Ravey.

During the past two and a half months I have been through a most remarkable country, full of opportunities awaiting both capital and labor. Eleven years prospecting around the mining camps of Alaska and the Yukon left me with an everlasting impression of the wonderful possibilities offered to those ready to come and settle in the great north-western section of the American continent, but what I saw in those days will not stand comparison with the country I have just returned from. The Peace River country abounds in nature's wonders. Its natural resources are immense. Millions of acres of arable land, intersected with rivers, lakes and streams, which make irrigation totally unnecessary, await settlement. A greater part of this area is practically open and ready for the plow. Peavine, vetches, red top and a variety of other natural grasses grow in the wildest profusion, and the few settlers who have gone in ahead of the railroad speak of the whole country through which I passed as being particularly adaptable for stock raising. One thing which should be particularly advantageous and inducive to rapid settlement is the unlimited supply of game, fish and wild fruits which can be taken with the greatest possible ease.

Throughout the timbered portions of the whole country, moose, deer, bear and antelope roam the woods. They are so numerous and almost tame in certain places that it will not tax the markmanship of anyone who has learned to handle a rifle to provide all the meat required for the table. The country has almost become overrun with rabbit of a very delicious flavor. The streams abound in wild duck and geese of different varieties, but at frequent intervals I ran into coveys of grouse and prairie chicken.

Fishing is another form of supply for the necessities of life. Whitefish, pike and pickerel of the finest quality, averaging five pounds in weight, can be secured in almost any quantity by using a net in the lakes, while salmon trout, speckled trout, greyling and numerous other varieties of game fish can easily be taken in any of the streams with the use of either fly or bait.

Another very valuable asset is the remarkable quantity of furbearing animals. Many settlers and the native Indians have relied on these as a means of livelihood for many years past. I was very surprised to find such a large number of valuable foxes roving the woods. There were black, silver grey and red specimens. In the Pouce Coupe district a fox ranch has already been established on a profit earning basis. Mink, martin, otter and beaver are also plentiful, and from these trappers also find a most useful source of income. In addition to all these splendid resources awaiting the coming of the settler, capitalists will soon realize that hundreds of profit earning investments are calling for capital, not only to develop the agricultural possibilities, but to open up mineral wealth.

Coal, gas and oil are known to exist. Large areas are underlaid with coal seams. At various points along the banks of the rivers settlers are able to collect large blocks of coal afloat, and all they have to do is to haul it to their cabins for fuel purposes, thus entailing less labor than wood splitting.

Leaving Vancouver the first week in July, I first went into the Albertan oil fields. The rush and excitement that followed the finding of oil in the Discovery well near Okotoks had somewhat fallen off, but some drilling was being done.

After leaving the Albertan fields I spent seven weeks on foot and raft in the vicinity north-west of Edmonton, covering a distance of about fifteen hundred miles going in via Grand Prairie, by way of Edson, through Pouce Coupe, Nose Mountain, Pine River Pass, on to Fort St. John and Peace River Landing, down to Grouard, at the head of Lesser Slave Lake, thence into Edmonton. Throughout the trip I took every opportunity of making detours off the main route. The natural resources in that territory are really surprising. Like many other parts awaiting settlement, the only thing lacking is transportation, but this is practically an assured fact. The lines of no fewer than four companies coming from the east have already been surveyed and partly constructed, while communication with British Columbia is promised as soon as details have been completed in connection with the line which will eventually run from Bella Coola through Pine River Pass, to the heart of the Peace River Country, and out to Hudson Bay. Government surveyors who have reported on the district are agreed that this route will afford the shortest way, with the lowest grade, for all the great north-west products, which in a few years will have to find an outlet to the markets of the world via a Pacific Coast port.

This being practically a virgin country, a traveller naturally has many obstacles to overcome. The Government wagon road, between Edson and Grand Prairie, a distance of roughly 240 miles, is fairly good in places, but has suffered from exceptionally heavy freighting between those points, but the settlers despite these obstacles are all highly pleased with the prospects.

After passing Grand Prairie, I went through an undulating country for about eighty miles to Pouce Coupe. Along this stretch about seventy-five per cent. of the land is open prairie ready for the plow, and the balance made up with scattering bluffs of poplar and spruce.

Several mills are already at work preparing lumber for building purposes, most of the timber being brought in from the heads of the streams in the surrounding district.

On my way I passed trading posts at frequent intervals, but none of them at the present give one the idea of developing into cities of the future, although Grand Prairie commands a position which should make a natural trade centre, capable of looking to the interests of settlers for many years to come, especially in view of the fact that the railroad magnates have already chosen this position as a divisional point.

The settlers who have thus far blazed the trail are chiefly drawn from the Anglo-Saxon race, many of them being either new arrivals from the Old Country or descendants of the United Loyalist stock from the east, both of which include a good percentage of the military type who acquired their land from South African scrip.

Leaving Pouce Coupe I continued my journey through the Nose Mountain country across the Cut Bank River, over the foothills into Pine Pass, through the Rockies, to within a few miles of a point I had reached last summer when making a trip from Bella

Coola over the proposed route of the Hudson Bay and Pacific Railroad. Excellent as the agricultural and mineral possibilities are from the coast inland to this point, I really believe the further one goes into the Peace River country are the indications the more encouraging. In addition to the farming prospects, mineral, oil, coal and gas are found here. Along the stream and river banks outcroppings of lignite and bituminous coal are in evidence, while in the foothills good anthracite has been found. To this end limited coal areas have already been secured by the C.P.R., C.N.R. and other railroad companies operating in the district.

While I was in this district I met an old Klondike friend, who had accompanied a party of Indians to a point near Nose Mountain. These Indians said they had known of the existence of gas there, which although they had never lighted it, they called the "Boiling Spring," on account of the rush and disturbance made by the gas escaping, which swept everything before it. On my way in this flow of gas was ignited and burst into flames, and it was still burning when I passed on my return journey.

I returned to the Coast by way of Peace River Landing. From the Rockies I journeyed over a north-easterly trail to the Peace River and after a very arduous trek arrived at a point near Fort St. John. Finding that the river here was not running at more than four and a half miles an hour, I decided to make the trip to Peace River Landing by a raft, which I knocked together with a few nails and rope. This fragile craft served to carry me by night and day to my destination. With the exception of two slight sand bars, the river along this stretch is quite easy to navigate, in fact, I found the going so good that I was able to sleep on the raft at night, floating down stream with but one interruption, when the raft made a bad bump at a sharp curve and ran into the bank.

At a very small expense the sand bars on the Peace can be removed and make the waterway open for steamboat traffic, while even to-day boats of light draught can easily be taken down stream.

Stopping at Dunvagen I was disappointed to find that the much talked of town is practically at a standstill. None of the settlers nor railroad men there have much confidence of this point developing into an important business centre. They claim that there has been far too large an area subdivided, the outlying districts being many miles from the line of the projected railway.

My next important stop was at the Peace River Landing, where a lively little city is springing up with great activity. Here the ranks of the pioneers have recently been swelled by the coming of hundreds of new settlers in advance of the railroad, which is now being constructed with all possible speed, along the banks of Lesser Slave Lake to this point. As a strategic and commercial centre this town has great possibilities, being surrounded by an extensive territory, naturally adaptable for stock-raising and agricultural pursuits, while its mineral wealth cannot fail to make fortunes for some.

From here going directly south over eighty miles of splendid agricultural country, I came to Grouard, a little town at the head of navigation on the Lesser Slave Lake, which, considering it is several miles off the railroad now being constructed by J. A. McArthur, of Winnipeg, has made tremendous strides since last summer, and the settlers there are confident that before long a second railroad will tap this section of the country and bring the present town of Grouard into direct communication with Edmonton, thereby giving the town access to all the markets of the Dominion and the States.

My journey from here to Edmonton was made over the Lesser Slave Lake, through Sawridge, a town at present at the head of steel and naturally bustling with enthusiasm. Tourists and prospectors making Edmonton their base should not miss the opportunity of taking a trip over the Lesser Slave—one of the most picturesque stretches of water I came across in all the fifteen hundred miles I travelled on foot.

COBALT SHIPMENTS.

The ore shipments for the week ending Dec. 25, were:

La Rose	85,300
Mining Corporation of Canada—	
Townsite City	172,820
Cobalt Lake	64,600
McKinley-Darragh	73,610
O'Brien	62,730
Dominion Red. Co.	84,700
Timiskaming	83,500
	544,960

Bullion shipments for the week ending Dec. 25th, were:

	Bars.	Ounces.	Value.
Nipissing	208	241,192	$117,882
*Crown Reserve	68	69,000	34,500
Crown Reserve	14	15,800	7,500
Dom. Reduction	41	46,371	23,050
Drum.-Fraction	4	4,956	2,478
	335	376,519	$185,440

*Shipped from Deloro.

The bullion shipments for the year to date are as follows:

	Ounces.	Value.
Nipissing	4,381,918	$2,995,984
Buffalo	791,319	454,249
Crown Reserve	627,072	338.202
O'Brien	294,552	150.422
Dom. Red. Co.	519,267	281,562
Kerr Lake	54,944	28,133
McKinley-Darragh	12,176	6,356
Foster Ls. Co.	2,187	1,141
Penn. Canadian	9,237	5,887
Casey Cobalt	2,893	1,484
Trethewey	2,000	1,200
Timiskaming	1,951	1,033
Bailey	1,462	763
Hargraves	794	414
City of Cobalt	28,724	16.148
Caribou Cobalt	165,608	87.316
La Rose	55,867	29,068
Townsite City	17,163	8,947
Drummond Fraction	4,956	2,478
Total	7,779,556	$4,245,900

Some copper music dies worth more than $1,000,000 have been commandeered at Leipzig by German military authorities to be melted to make gun mountings, shells, caps and dies.

Nipissing Mines Co. declared regular quarterly dividends of 5 per cent., payable Jan. 20 to stock of record Dec 31. Books re-open Jan 18.

THE DISTILLATION OF COAL*

By F. C. Lucas.

Coal is a complex mixture of hydrocarbons which practically defies analysis, except as to its ultimate composition, yet from it we get a greater variety of products than from any other known substance, and it is only by destructive distillation that these products may be obtained.

The distillation of coal was first started with the idea of securing gas for illuminating purposes, and coke for metallurgical work, although it did not occur to the pioneers in this work that the two processes might be carried on at one and the same time. In the manufacture of gas, the coke was a by-product, and in the manufacture of coke, the gas was a by-product, and in both cases these by-products were regarded more in the light of necessary evils than as valuable sources of income. Even at this late date, 100 years since coal gas was first made for public use, and about 80 years since coke was made in large quantities for metallurgical use, gas plants in many cases have difficulty in disposing of their residual coke, and many coke plants are letting all their gas go to waste in the air, with all the other valuable by-products which might be recovered.

At present the distillation of coal is carried on for three main purposes, viz., the manufacture of illuminating gas, the manufacture of coke and for the recovery of oil. The latter refers more particularly to the highly bituminous shales. While the aim in each of these processes is to recover a different main product yet there are other products or by-products, which are of such value as may often return the capital cost of the whole plant in a very few years. Until the last few years each of these processes has been carried on separately. The manufacturers of gas did not make coke of such quality as could be used for metallurgical purposes nor did the coke maker, if he saved the gas at all, take care to make it of such quality as to be suitable for illuminating purposes.

In the manufacture of illuminating gas, it has been the general practice to distill, or carbonize, the coal in small lots in sealed retorts, these retorts being heated by burning a portion of the resultant coke. The remainder of the coke has been sold to whoever would take it for fuel purposes. In the early practice, when the retorts and settings had not reached their present highly efficient state, the yield of gas was low; partly because of the low temperature, and partly because of the losses due to the inefficiency of the plant. In order to make the gas saleable it was necessary to take out the tar and ammonia and sulphur, and in the early days of the process all three products were wasted, and almost the same may be said of some of the smaller gas plants of the country to-day.

Beehive Oven—The early history of coke making, and also the present state of a large proportion of it in America, equals, or excells, in wastefulness anything else the country has ever seen. The earliest attempts were made by piling the coal in mounds and covering it with sods wet straw and earth and burning the gas off in the same manner as charcoal has often been made. This process was modified and a brick oven was made practically the same shape as the original mounds, with a hole in the top to let the gas escape. By this process not only is a portion of the coal burned up to heat the oven, but the gas with all its valuable by-products is allowed to go to waste. Strange as it may seem, more than half the coke in America is still made by this process.

Waste Heat Oven—The next step was to build what is known as a waste heat oven. In this type the ovens are sealed so that there is no loss of coal by burning or direct loss of gas to the air. All the gas escapes into flues in the side walls of the oven and is there provided with the necessary air for combustion, thus supplying the heat necessary to carbonize the charge of coal in the oven. The hot gases on the way to the stack are passed under boilers and so provide steam; truly a great advance over the early Bee-hive oven, but still wasteful in so far that all the by-products in the gases are destroyed.

By-Product Oven—The next step was in the building of an oven providing for the recovery of the gas and all other by-products, viz., Tar, Ammonia, Benzol and Cyanides. If the gas is used for such purposes that it is necessary to extract the sulphur, this may be recovered for the manufacture of sulphuric acid, which is in turn used for the recovery of the ammonia in form of ammonium sulphate.

In the by-product oven the coal is distilled in a sealed chamber, the walls of which contain a number of vertical or horizontal flues similar to those in the waste heat oven; but instead of the gas going directly from the oven into these flues it is drawn off into mains and put through apparatus for the extraction of the tar, ammonia and benzol, and a portion of it varying from 45 to 60 per cent., according to conditions, is returned to the ovens and burned in the oven wall flues to provide the necessary temperature for distillation. The remainder of the gas may be used for any purpose required, such as heating furnaces, steel furnaces, illuminating purposes or steam raising or for use in gas engines. The quantity of gas and other by-products recovered is to a great extent dependent on the per cent. of volatile matter in the coal, but in the principal coals of Nova Scotia the yield is fairly high. Tar about 10 gallons per ton of coal, ammonia 5-6 lbs. or 20-24 lbs. recovered as sulphate, and 11,000 cubic feet of gas of which 5,000-6,000 would be surplus or over and above the quantity required to heat the ovens. When the gas is intended to be used for illuminating purposes it is general to install two collecting mains on the ovens so that the richer portion of the gas, containing the greater part of the illuminants, which comes off from the coal during the earlier hours of distillation, may be kept separate from the leaner gas which comes later. The leaner gas is used for heating the ovens and the rich gas is of such high quality as to be suitable for distribution for illuminating purposes without any further enriching. After the ammonia and tar are recovered, it is passed through oxide of iron purifiers and is then ready for distribution. In this case the benzol would not be recovered as it is one of the principal illuminants in the gas. The lean gas is treated in the same manner as the rich for the extraction of tar and ammonia, but is not purified before being burned in the oven flues.

*A paper presented at the Annual Meeting, Mining Society of Nova Scotia, Sydney, 1914, and published in the Bulletin of the Canadian Mining Institute.

If the gas is to be used for any of the other purposes mentioned, it may not be necessary to extract the sulphur. For gas engine practice, it used to be considered necessary to have the sulphur content reduced to a minimum, but I believe that there are engines on the market now that do not demand such purification. If the ultimate aim is the generation of power, it is beyond doubt more economical to use gas directly in internal combustion engines rather than burn it under boilers. Considering the fuel value of the gas and the power obtained by burning it under boilers and using the steam in the most economical engines 12 per cent. efficiency would be high even if the gas was burned in the latest type of flameless combustion boilers the makers of which guarantee over 90 per cent. thermal efficiency but in the internal combustion engines 30 per cent. efficiency is possible. In certain localities or under certain conditions it may be desired to reserve the total gas obtained from the distillation of the coal for use other than on the ovens. In such cases gas producers are provided and coke breeze or low grade non-coking coal is used to generate gas for heating the ovens. The gas producers may also be equipped with apparatus for recovery of ammonia. As a matter of fact the quantity of ammonia recovered per ton of coal is far greater in gas producer practice than in ordinary gas or coke practice because in the latter a large proportion of the nitrogen in the coal is retained by the coke and part of that which is liberated and unites with hydrogen to form ammonia is afterward broken up by the high temperature in the oven.

With regard to the other coal by-products viz. tar, ammonia, and benzol, there are a great many different types of plant for their recovery, but it is not my purpose to enter into a detailed description of these plants, or discuss their respective merits.

Tar Products—Tar is of itself such a complex substance and has so many by-products which may be obtained by further distillation, that it would be almost impossible to enumerate them, but the most commonly known of these products may be mentioned, viz., pitch, which is the hard residue after the volatile constituents have been distilled off and creosote and other oils. I do not know that there is any unalterable standard or analysis to which creosote oil must conform, but the different oils extracted from the tar are many, and from these in turn may be distilled other products down to drugs and perfumes. The value of creosote oil as a wood preservative is so well known that I need not dwell at length on it except to say that since the price of lumber for railroad ties, pit props, bridge timber, etc., has practically doubled in the past fifteen years and that creosoted timber will last many times longer than the ordinary timber, it seems as if it would be profitable to have a more general use of preserved timber in such work.

The lighter oils derived from the distillation of tar are used as solvents for rubber, and fuel for internal combustion engines as well as providing the base for many of the finer products before mentioned.

The main use for the pitch at present manufactured is as a binder for coal briquettes. The briquetting industry has grown to very large proportions in Europe, and in recent years has received a good start in this country; several plants having recently been constructed in Cape Breton alone. There is no doubt that this industry will grow quite as fast as the market can supply it with pitch, for the advantage of burning briquettes instead of fine coal has been so conclusively proven that it is likely to be only a question of time until the demand will be such that colliery owners will be forced to briquette the fine coal which may not be used for coking. Pitch is also used in considerable quantities for roofing as well as a substitute for asphalt in road making. It is also used as the base of paints, particularly for covering iron work.

The undistilled tar may also be used for various purposes, although it is better to have it heated long enough to expel all water. A large quantity is used in the preparation of paper and felt roofing. It has also been proven that tar may be used in the Diesel engine with very great success. It is also used as fuel under boilers and in various kinds of heating furnaces. One purpose for which tar is often used, and it might be well if such use was more extended, is coating roads. After the road has been built and properly shaped up it is sprayed with tar. A clay road well rounded and ditched and sprayed with tar is not only dustless in dry weather but mudless in wet weather and the cost of applying the tar is very small when compared with the improved state of the roads so treated.

Ammonia may be recovered from the gas in several forms, such as concentrated liquor for refrigeration purposes, ammonium chloride and ammonium sulphate, but in general practice the bulk of it is recovered in the latter form; the ammonia gases being either directly absorbed by a dilute sulphuric acid bath or first absorbed by water, which is in turn distilled to give off the ammonia for absorption by the acid. The principal use for ammonia sulphate is as a fertilizer and the market for sulphate of ammonia for this purpose is like that for all artificial fertilizers, widening each year.

Benzol—The recovery of benzol from the gas is becoming more imperative each year as the number of internal combustion engines increases. The bulk of the world's production at present is used in automobile engines. Benzol is not only a substitute for, but it is better than gasoline. Repeated tests have proven that a given quantity gives from 15-20 per cént. greater mileage than gasoline. A considerable quantity of benzol is also used by retort gas plants for enriching their gas and bringing it up to the required standard of candle power. More of it with zylol and toluol recovered at the same time, is used by manufacturers of rubber as a solvent. Most of the coke oven plants of Europe recover the benzol from the gas and I do not think it will be long before every coke oven plant will recover this product; except in such cases where the gas is used for illuminating purposes and a high candle power standard has to be maintained.

The Cyanides may also be recovered by a fairly simple process, but hitherto the market for cyanide compounds has not warranted the installation of many plants for their recovery. However, there is a further process now being tested with every prospect of success, which aims to recover the cyanides and then convert their nitrogen into ammonia, which will then be recovered in the usual form as sulphate.

Sulphur.—If it is necessary to purify the gas from its sulphur content before using it, the sulphur may be saved as a further by-product and used for making the sulphuric acid necessary for the recovery of the ammonia as sulphate. In this process the gas is passed through boxes containing layers of bog ore which retains the sulphur. The ore layers are changed from time to time, the foul ore lying exposed to the air for a time, and it can then be used over again. This may be kept up until the ore will contain up to 45-50 per

cent. of metallic sulphur; making a very valuable as well as a very easily worked sulphur ore.

Advantages—The whole question of the most economical consumption of coal, which I believe, must begin with destructive distillation, is far too large to be dealt with at all fully in a single paper, and I can only call attention to some of the facts as they exist, and make mention of some of the things that would seem to be possible if all the coal consumed in Nova Scotia was used with the greatest degree of economy.

It would seem to me to be quite within the range of possibility that coal might be subjected to destructive distillation at the various mines or in the larger centres of population, that all cities and larger towns could have gas supply for cooking, heating or lighting at a price not exceeding half of that charged by any gas plant in Canada to-day. The gas may be conveyed for a hundred miles or more in pipes if the market conditions warranted.

That every city and town and also most of the rural districts could be supplied with electric power practically as cheap as that supplied throughout the Niagara Peninsula of Ontario by the Hydro-Electric Company.

That the roads of Nova Scotia might be as good as any in the world if they were properly prepared and treated with tar from the distillation of coal.

That practically all smoky stacks could be got rid of by using, where solid fuel is necessary, coke and briquettes made from the fine coke dust and low grade coals unfitted for distillation.

That, in view of the fact of the coal deposits of Nova Scotia being so large and so widely distributed, there is no good reason why, if something was done along the lines suggested, Nova Scotia should not be one of the richest and at the same time the greatest manufacturing province of the Dominion.

According to a North Bay despatch an important mineral discovery has been made at Rutherglen, 20 miles from North Bay.

NICKEL EXPORT.

That the International Nickel Company, the chief source of the world's supply of nickel obtained from Canadian ores, has no European "entangling alliances" and never had any; that it has been and is working in accord with the Imperial and Dominion Government suggestions, and will continue in this harmonious operating relationship; that it has complied with every official requirement designed to keep nickel from reaching the enemies of the allies, and even from neutral nations since the Imperial and Dominion Governments at the beginning of the war intimated their wishes, has been asserted by the issuance of the following:—

"To the Canadian Public.—In view of the widespread comment in the Canadian daily and technical press as to the destination of shipments of nickel made and being made by the International Nickel Company and obtained from material of Canadian origin, as well as the references to a European controlling influence in its affairs, the company begs to submit to the Canadian public the following statement of facts:

"1. There is absolutely no influence exerted in the conduct of the affairs of the company or of any of its subsidiaries, by any European steel manufacturing or similar industry, nor by any individual connected with them, nor by anyone in European financial circles.

"2. Full information as to the destination of shipments of nickel made by the company has been in the possession of the Dominion authorities since the outbreak of the European war, and they are currently kept cognizant of all exports of nickel, as well as of all local shipments made by the company.

"3. While recognizing that refining at the point of production, i.e., the mines, is the ideal condition, economic conditions, seriously affecting cost of production, have dictated the present location of nickel refining, and with the present state of the art, any material change in such economic conditions would react in a manner most detrimental to the Canadian nickel industry.

"The Internationel Nickel Co.,

"A. MONELL, President."

Canadian Copper Company's smelter at Copper Cliff, Ont.

CONIAGAS MINES, ANNUAL REPORT

The report of the Coniagas Mines, Limited, for the year ending Oct. 31, 1914, has been issued. President R. W. Leonard says:

Operations for the year ending October 31st last have not been so prosperous for the company as the preceding three years, owing to the low price of silver, the dislocation of business caused by the war, and largely to the diminishing output of high grade ore sacked in the mine, making the silver shipped more dependent on the capacity of our concentrating plant than in previous years.

The year's operations must be considered as satisfactory under the outlined conditions. No reduction in force or rates of wages has been made.

The total shipments of silver from this property aggregate over 20,000,000 ozs. The estimates of additional reserves of ore in sight are about 1,325,000 ozs. less than the shipments for the year. No valuable discoveries have been made during the year on outside claims staked by the company.

The Coniagas Reduction Company, owned by the Coniagas Mines, Ltd., has treated all the ore from the mine, and some customs ore, and is in excellent physical condition, running constantly, employing an average of 166 men; but the low price of silver and the restricted market for by-products has necessitated heavy banking accommodation, which has been taken care of by the mine.

GENERAL VIEW OF SHAFT HOUSE AND MILL, LOOKING WEST

In the future we may hope for better prices for our silver, for a better demand for the by-products of our smelter, and must trust to the results of further development underground showing up high grade ore in ground as yet undeveloped, though promising.

During the year, in addition to the dividend and bonus paid on November 1, 1913, of $560,000, the mine paid the following:

February 1st, 1914	$360,000
May 1st, 1914	360,000
August 1st, 1914	360,000

and declared a quarterly dividend payable November 1st, 1914, of 6 per cent., which amounted to $240,000.

The dividends paid to October 31st, 1914, make a total return to the shareholders since incorporation in November, 1906, of $7,000,000, and the ore reserves as estimated by Mr. Rogers amount to 11,904,000 ozs.

The total silver shipments from the mine during the year amounted to 2,497,394.88 ozs., which was contained in 484.88 tons of mine ore, and 688.44 tons of concentrates (dry weight). This ore was mined and concentrated at the mine at a net cost of 12.444c. per oz., as compared with 8.776c. per oz. for the previous year. This cost includes all overhead expenses, royalties, and all other expenses exclusive of shipping, smelting, refining and marketing charges, which amounted to 3.585c. per oz. of silver, as compared with 4.321c. for previous year.

The average price received per ounce of silver was 56.75c. as compared with 60.55c. for previous year.

Mr. R. P. Rogers, assistant to the President, reports in part as follows:

The total tonnage of ore milled was 54,522 or an average of 2.93 tons per stamp for 24 hours, as compared with 54,890 tons, averaging 2.95 tons per stamp, for the

ious year. There were 496.4 tons of high grade entrates shipped, and 251.8 tons of low grade slime, former averaging 2,030 ozs. per ton, and the latter oz. per ton, mill heads averaging 24 oz. per ton, as pared with 28.3 for the previous year.

e sand tailings from the mill averaged 3.18 oz. ton, and the slime tailings 6.66 oz. per ton. The age of general tailings was 4.21 oz.

here was a total of 493 tons of mine ore shipped, h averaged 2,944 oz. per ton. Development work ing the year has been confined mostly to following mall veins in older portions of the mine, continuing osscut on third level, southerly to connect with No. aft and sinking No. 4 shaft to our fourth level.

l work in stopes and drifts, also broken rock on s in mine, is shown on accompanying plans and ons. The broken rock on stulls has been increased 3,000 tons during the year.

	Mine Ore	Concentrates	Total Ozs. Silver Shipped	Total Ozs. Silver paid for
1st Quarter. . . .	361,625.92	205,849.48	567,475.40	538,865.53
2nd Quarter. . .	360,234.01	224,891.74	585,125.75	555,543.87
3rd Quarter. . ..	369,671.26	291,117.14	660,788.40	628,281.65
4th Quarter. . ..	359,991.08	324,014.05	684,005.13	650,818.07
	1,451,522.27	1,045,872.41	2,497,394.68	2,373,509.12

Total Shipments From the Mine.

Year, Nov. 1 to Oct. 31	Mine Ore Tons	Mine Ore Ozs.	Concentrates Tons	Concentrates Ozs.	Total Tons	Total Ozs.
1905-06 ...	289	657,513	....	....	289	657,513
1906-07 ...	2,655	1,341,372	....	....	2,655	1,341,372
1907-08 ...	Mine Ore and Concentrates				627.5	1,457,240
1908-09 ...	350	807,253	426	599,975	776	1,407,288
1909-10 ...	330.1	979,630	645.5	949,901	975.6	1,929,531
1910-11 ...	619.1	2,142,961.71	1,418.4	1,646,312.20	2,037.5	3,789,273.91
1911-12 ...	650	1,944,212.80	1,287.5	1,564,164.47	1,937.5	3,508,377.27
1912-13 ...	735.8	2,249,394.32	1,034.30	1,323,004.56	1,770.10	3,572,398.88
1913-14 ...	492.9	1,451,522.27	748.2	1,045,872.41	1,241.1	2,497,394.68
	6,121.9	11,573,859.10	5,559.9	7,129,229.64	12,309.3	20,160,388.74

THE CONIAGAS REDUCTION COMPANY, LIMITED
Smelter and Refineries at Thorold, Ontario

Development of new ore bodies during the year is mated at 1,072,000 oz., shipments being 2,497,000 oz. re reserves to October 31st, 1914, are estimated as ows:

	Ounces
461 tons high grade ore at 3,000 ounces	7,383,000
605 tons high grade ore at 2,000 ounces	1,210,000
250 tons mill rock (in place) at 20 ounces	3,025,000
125 tons broken ore on stulls in mine at 40 ounces	2,085,000
100 tons broken ore on stulls in mine at 20 ounces	862,000
500 tons mill rock on surface dumps, at 30 ounces	315,000
Total.	14,880,000

llowing 20 per cent. for possible over-estimation uld leave an ore reserve on the 31st of October, 1914, 11,904,000 oz., which I consider a conservative basis which to estimate for the ensuing year. The estites are based on careful surveys made by R. E. K. elands.

The following was the quarterly output of the mine the fiscal year in ounces of silver, all of which was pped to the Coniagas Reduction Company, Ltd., at orold:

Work done to date and work done during the year ending October 31st, 1914:

	Total to Oct. 31st, 1914	Total to Oct. 31st, 1913	Work done during 1913-14
Shaft sinking, feet	802	610	192
Drifting, feet	15,982	14,939	1,043
Croscutting, feet	6,805	5,899	906
Winzes, feet	519	441	78
Raises, feet	895	819	76
	25,003	22,708	2,295

	Tons removed since beginning of operations to Oct. 31st, 1914	Tons removed to Oct. 31st 1913	Tons removed during 1913 and 1914
Cross Cutting and waste .	35,293	27,914	7,379 Barren Rock
Drifting.	52,846	49,271	3,575 Pay Rock
Stoping.	249,395	198,592	50,803 Pay Rock
Open Cutting	4,780	4,780	..... Pay Rock
Shaft Sinking	2,554	2,265	289 Barren Rock
Winzes and Raises	4,151	3,602	549 Pay Rock
	349,019	286,424	62,595

Ore Milled in Tons to October 31st, 1914.

Total to Oct. 31st, 1914	Total to Oct. 31st, 1913	Milled during 1913-14
282,127	227,605	54,522

Surface Dumps.

Remaining Oct. 31st, 1914	Remaining Oct. 31st, 1913	Removed during 1913-1914
10,500	10,500	......

Milling Ore and Rock Hoisted, Tons.

	Total to Oct. 31st, 1914	Total to Oct. 31st, 1913	During 1913-1914
Milling Ore	282,127	227,605	54,522
Waste Rock	39,701	32,121	7,580

During the year we have started operations at our No. 4 shaft. The shaft house and hoist house have been erected, and shaft about completed to our fourth level. This shaft is located in the Town of Cobalt, and the necessary mining operations will necessitate the removal of many buildings which have been erected by those who purchased surface rights. I would recommend that most of our prospecting for the coming year be carried on through this shaft. I consider prospects very favorable for discovering valuable ore bodies in this vicinity during the coming year. From the estimate of ore reserves it will be seen that there is a considerable increase of mill rock in place, this is mostly accounted for by many of the stopes being wider than estimated on in my last report. The broken rock on stulls in mine and mill rock on surface dumps is sufficient to keep concentrating mill running at its present capacity for about two years without breaking any new ore.

We now have a total of 42 houses on the property which are owned by the company and rented only to employees. The total rent for those houses amounts to about $330 per month and rents are so adjusted that the capital invested with interest will be returned to the company.

The sleep camps and dining room have accommodated an average of 54 men, charge for such accommodation being 60c. per day per man, though the cost to the company has been 75c.

On January 27th the majority of underground employees went on strike without giving the management due notice. Operations underground were affected for two days when full force were put on, but 30 of the former employees were not taken back. With the exception of this slight interruption, there has been no serious delay.

In conclusion I might say that the output of the mine for the coming year should be about equal to the year covered by this report.

GREAT NORTHERN ORE.

That after January 1 M. A. Hanna & Co. will handle the output of practically all Great Northern Ore properties, means that the cancellation of the Steel Corporation lease will cause little delay in marketing Hill ores.

Great Northern starts its career as an independent seller of ore in competition with other Lake Superior ores at a poor time. The steel industry is at present operating around 35 per cent. of capacity, iron ore prices are very low and the prospects for 1915 are not encouraging by any means.

It is estimated that the Steel Corporation shipped 6,000,000 tons, minimum requirement, and 440,463 tons additional from the Hill mines in 1914, equivalent to over 30 per cent. of combined shipments by United States Steel of approximately 17,000,000 tons. Great Northern Ore trust cannot ship a large tonnage of ore in 1915, and margin of profit per ton on what it can sell will be narrow in comparison with the profit derived from sales to United States Steel.

The 1914 sales of 6,440,000 tons of iron ore would be sufficient to supply total normal requirements for four of the country's largest independent steel companies, namely, Republic, Lackawanna, Bethlehem and Cambria. On present curtailed output of steel, the annual requirements of these four companies would be not much over 3,500,000 tons. From this it is evident that sales of Hill ore will be greatly restricted unless there is a substantial improvement in the steel industry.

DOME.

Dome Mines' November production was slightly under the October figures, which constituted a monthly record. However, the value of the gold produced was higher, and indeed was only exceeded in value by the production of three other months in 1914, or six other months in 17 months.

The record of the Dome for the past seventeen months is as follows:—

	Tons Milled.	Value Gold Produced.	Value. Per Ton.
1913.			
July.	11,150	$75,958	$6.81
August.	10,728	67,660	6.31
September.	10,790	70,135	6.50
October.	12,370	118,000	9.53
November.	13,820	121,150	8.76
December.	13,740	106,904	7.93
1914.			
January.	13,900	111,500	8.02
February.	12,010	69,000	5.74
March.	14,979	87,657	5.85
April.	14,770	97,454	6.59
May.	16,180	62,109	3.83
June.	18.250	83,421	4.51
July.	19,780	82,984	4.19
August.	20,170	90,893	4.50
September.	21,940	99.301	4.52
October.	22,500	95,880	4.70
November.	22.040	96,770	4.39

SPELTER.

According to the Boston News Bureau the present advance in spelter is not difficult to understand when it is realized that Germany, Austria and Belgium, whose mines and smelters ordinarily produce 50 per cent. of the world's output, are now either shut down or have seriously curtailed operations. The result is that the United States, the largest individual producer, has had its surplus stocks licked up by an insistent foreign demand which shows no sign of abating. Fortunately the domestic demand is comparatively quiet owing to the depression in the steel business.

Great Britain, which consumes a very large amount of spelter, but produces little, is hardest hit, as ordinarily she depends on continental Europe for a large portion of her supply. For example, in 1913 Great Britain consumed 215,000 tons of spelter and produced but 65,000 tons.

The following table shows production and consumption of spelter by countries in 1913 (tons):

Country.	Production.	Consumption.
United States	347,000	295,000
Germany and Austria .	330,000	300,000
Belgium.	218,000	84,000
France and Spain	78,000	96,000
Great Britain	65,000	215,000
Russia.	....	37,000
Miscellaneous.	52,000	40,000
Total.	1,090,000	1,067,000

CONSOLIDATED MINING AND SMELTING CO., OF CANADA, ANNUAL REPORT

The report of the Consolidated Mining and Smelting Company of Canada, Limited, for the year ending September 30th, 1914, has just been issued. President Matthews says:

The net profit, after writing off $193,149.69 for depreciation, amounts to $474,012.24, out of which four dividends (a total of 8 per cent.), amounting to $464,376, have been paid, leaving a balance of $9,636.24, which, added to the balance at the credit of the profit and loss account as shown last year, makes a total of $1,727,286.73 at the credit of that account. The property account has been increased during the year by the sum of $283,422.31, which includes the cost of claims adjoining the Rossland properties and the Sullivan group, and stock in the Silver King Mines, Limited, together with a portion of the amount expended on the development of the Sullivan, Silver King and other properties which had not commenced shipments, or which only shipped ore to a limited extent. The bank overdraft has materially increased, the reasons for which are given in the General Manager's report. It can, however, be reduced very substantially when the conditions of the metal markets warrant the Company in disposing of the large stock of refined metals on hand. The development work at the Rossland mines and also at the Sullivan group is very encouraging, and the various other properties are looking well, while the alterations and improvements at the smelter make for efficiency and economy.

General Manager R. H. Stewart reports in part:

Total tonnage smelted at Trail was 374,771 tons, having a gross value of $6,000,662, showing an increase in the average monthly tonnage smelted over last fiscal year (15 months) of about 4,090 tons. Production details follow:

Consolidated Mining and Smelting Co. of Canada, Production Oct. 1, 1913, to Sept. 30, 1914.

Mines.	Weight in Tons	Gold in Ounces	Silver in Ounces	Lead in Pounds	Copper in Pounds	Gross Value
Centre Star, ore	172,379	....	....	....	....	....
Centre Star, concentrates	9	90,762	63,131	....	1,804,191	$2,139,522
Le Roi, ore	80,499	....	....	....	....	....
Le Roi, concentrates	137	31,030	39,064	....	1,817,004	894,892
Sullivan, ore	30,919	....	431,746	21,390,103	....	879,829
St. Eugene, ore	1,217	....	26,119	992,385	....	45,782
Molly Gibson, ore	572	7	29,964	137,278	....	22,701
Number One, ore	5,790	76	185,230	121,382	....	112,908
Highland, ore	1,346	....	....	....	....	....
Highland, concentrates	2,520	....	64,579	3,929,856	....	203,388
Maestro, ore	262	....	4,421	241,491	....	10,403
Richmond-Eureka, ore	541	....	23,698	162,960	....	20,269
Lucky Thought, ore	36	....	4,295	33,279	....	3,871
Ottawa, ore	342	....	50,900	....	....	29.070
Silver King, ore	(16,031)	(266)	(123,549)	....	(589,286)	(157,581)
Smelted, Trail Smelter	374,771	129,083	2,568,301	34,617,318	3,645,997	6,000,662

The company's mines in Rossland continue to show an increase in the amount of ore available, the greater part of the increase being due to tonnage developed in the Le Roi mine, where development work has yielded very satisfactory results.

The crosscut from the Centre Star shaft, mentioned in the last annual statement as being driven to connect with veins developed on and above the War Eagle 14th level, and 300 ft. below that level, reached the ore about the first of January, and although the ore bodies so far opened up on this 16th level have not been as large as on the 14th level, the prospects are that a large tonnage will be obtained between these levels.

The Centre Star shaft below this level is now being repaired, with a view to driving another crosscut, below this 16th level, to tap the vein at three hundred ft. greater depth.

The satisfactory results of development in the lower levels of the War Eagle strongly indicate the favorable possibilities of still deeper development.

At Kimberley development of the Sullivan group has demonstrated a very large amount of complex zinc-lead ore, of which a considerable portion can be shipped under present conditions and smelted for lead; while there remains a very large tonnage, which is comparatively high in zinc, and is, as yet, not available for shipment, although its gross value is upwards of $20 per ton.

Other properties owned by the company, most of which are under development, have been closed down owing to the situation imposed by the war, mainly on account of the facts that the prices of metals are low, most of the metals difficult to market, and many of the properties require considerable money for development.

There have been no new developments in the St. Eugene mine, which was operated in a small way during part of the year.

The Molly Gibson was operated for a short time, but was closed down at the commencement of the war, little development having been done; but such as has been done has shown the vein in the bottom level to be as promising as in the levels above.

Nothing new has been developed in the Richmond-Eureka group.

The Lucky Thought mine, at Silverton, mentioned last year as being under bond to the company, has been developed to a small extent, with the exposure of some small shoots of high-grade ore, but nothing of importance has so far showed up.

At Slocan City the Ottawa mine has showed up some small shoots of high grade ore.

At Ainsworth developments in the Highland and No. One mines have only been fairly satisfactory. Both mines have produced considerable ore during the year, but the reserves of ore have not been increased. The same applies to other properties at Ainsworth.

New Properties.

The charge to property account includes purchase of the Mabel mineral claim, adjoining the Centre Star properties in Rossland; the purchase of a one-fifth interest in the Pilgrim mineral claim, in Rossland, adjoining the War Eagle mine; the purchase of the Paul Boy and Eddie J. in Rossland; the Annie E. and the property of the Canadian Goldfields Syndicate in Rossland; purchase of some stock of the Silver King Mines, Limited; and some small expenditures on claims adjoining the Sullivan.

There is also included in this charge a portion of the amount expended on development of the Sullivan, Silver King, Ainsworth and Slocan properties, which, owing to conditions imposed by rebuilding at the smelter, were unable to ship to full capacity during the year, or had not reached the shipping stage.

dations, floors and retaining walls, all of which have been replaced with concrete; rebuilding of the fire protection system was also necessary during the year.

Small expenditures were made on tracks; on tunnels for recovering ore from storage, and on extra locomotives for charging the furnaces.

The objects of these alterations and improvements have been to increase the capacity of the plant, to increase recoveries and to decrease costs of operation.

The lead plant formerly handled a considerable tonnage of high-grade clean concentrates, comparatively low in sulphur and free from zinc, which was supplied mainly from the St. Eugene mine. With the working out of the St. Eugene mine, it has been necessary to replace the tonnage, to a large extent, with ore of lower grade and of a much more refractory nature, largely from the Sullivan mine, and carrying more sulphur and requiring more capacity for roasting and furnacing in order to produce an equal tonnage of lead.

In the roasting plant, particularly, the seven Godfrey roasters with which the smelter was previously

Outcrop of Vein at Centre Star Mine, Rossland, B.C.

Improvements.

Expenditure on plant account during the year has been $571,207.01. Of this amount $482,134.44 has been spent in improvements to the smelter. This has been expended mainly as follows: On re-building the lead plant, including two Wedge roasters, having a capacity each of from 85 to 95 tons per day; conveyors and automatic scales for handling the ore from storage to the roasters, and for handling the pre-roasted product from roasters to sintering pots; three new lead blast furnaces and extensions to building, with crane for handling receivers and by-products, such as matte; a Cottrell plant for clearing the blast furnace gases of lead fume; flues connecting the blast furnaces with the Cottrell plant; new charge cars and some small equipment for the lead sampling mill.

Alterations to the copper plant, include re-building of three of the five blast furnaces and increasing the dimensions of two of them; building of a new smoke stack; repairs to the flues; installation of a crane in the copper furnace building, and rebuilding of the launders leading to the slag dump.

Improvements in the blower-room, include installation of an additional blower, having a capacity of 40,000 ft. of air per minute; extensive repairs to the blower-room on account of the rotting of timber foun-

equipped had a capacity of only 25 tons per day each of Sullivan ore; the two Wedge roasters, just installed, have a capacity each of from 85 to 95 tons per day, and are costing at present about 50 cents per ton less to operate, the saving being mainly in fuel and firing.

The installation of conveyors handling the ore to and from the roasters will still further reduce costs of operation of the roasters, by substituting mechanical equipment for manual labor.

The costs of operating the Heberlein pot plant have already been materially reduced by the substitution of mechanical appliances for hand labor, which alterations were made last year.

The building of new lead furnaces was made necessary by the condition of the old ones, which had been in operation for a long time, and it was considered advisable in rebuilding them to place them further from the copper plant, in order to allow for any necessary extensions to the copper plant; also to allow for better arrangements for charging and handling the products.

The installation of the Cottrell plant was very necessary on account of large losses in fume from the blast furnaces. The flues and Cottrell plant are now saving in the neighborhood of eight tons per day of material high in lead, a considerable portion of which was previously lost.

Improvements to the copper plant were made necessary by the wearing out of jackets on the old furnaces. In rebuilding, two of them have been increased in size from 300 in. to 420 in. in length, and from 42 in. to 50 in. in width at the tuyeres. The enlarged furnaces so far show an increase in smelting capacity of from 60 per cent. to 80 per cent. over the older ones. This increase in capacity will result in a proportionate decrease in cost of labor and, probably, in a decrease in cost of coke per ton of ore smelted.

Generally speaking, we believe that the changes made in the smelter during the past two years will result in sufficient saving in costs of operations and recoveries to pay for themselves within the next two or three years' operation.

At the Number One and Highland mines a hydraulic power system was installed which will save its cost in less than a year's operation. Other expenditures at Ainsworth have been, mainly, equipment of the properties with air drills and hoists, with a few small additions to the Highland sampling mill.

At the Sullivan mine a boiler plant was installed to operate the compressor during the season of low water—the boilers being transferred from the St. Eugene plant.

At the Centre Star it was found necessary to rebuild the shipping bins.

General Conditions.

The increase in amounts due the banks is attributable to the following:

Expenditure on plant account at the smelter and mines. Increase in metals on hand at the smelter, due, partly, to inability to smelt the ores received during the heavy repairs, and, partly, to increased metals carried at the refinery on account of increase in the number of lead tanks in operation. Development of new properties, from which returns have not yet been received in the shape of ore shipments. This amount would have been very materially reduced at the time of writing had the metal markets been normal. Owing to the present situation, however, heavy accumulations of refined metals have taken place, which may have to be held for a time, or until the markets resume more normal conditions. The unexpected and sudden drop in the value of metals has made a very considerable difference in the estimated value of stocks on hand—the drop in silver at September 30th amounting to about 8 cents per oz.; while copper sold as low as 11.1 cents per lb. as compared to 16 cents in the previous year.

Conditions at the mines, generally speaking, have been satisfactory, with a prospect for increased tonnage had it not been for the closing down of a number of mines owing to the unsettled condition of metal markets.

Management.

The properties and departments of the company have been in charge of the following gentlemen: Mr. S. G. Blaylock, Asisstant General Manager; T. W. Binay, Comptroller; James Buchanan, Superintendent of Smelter; M. H. Sullivan, Assistant Superintendent of Smelter; J. F. Miller, Superintendent of Refinery; M. E. Purcell, Superintendent Centre Star Group of Mines; E. G. Montgomery, Assistant Superintendent; F. S. Peters, Superintendent Le Roi Mine; C. H. McDougall, St. Eugene and Sullivan Mines; K. B. Carruthers, Molly Gibson Mine; W. A. Cameron, Slocan Lake properties; W. M. Archibald, J. M. Turnbull and A. W. Davis, Mining Engineers.

MOND NICKEL.

It is stated that the Mond Nickel Co. will proceed at once with all the enlargements and improvements contemplated at the smelter at Coniston. These improvements and enlargements were intended to be scattered over a period of years, but now owing to the urgent need of nickel in the British and Allied navies the plant will be rushed to completion at once.

It is incidentally learned that recently there has been an insistent demand for a very large tonnage of nickel matte from Russia.

The enlargements at the Mond plant will, when they are completed, almost double the capacity.

It is improbable that much if any of the nickel matte produced by the Mond Company found its way to Germany because the orders from the British Government were always much larger than the English company could supply; but it is quite certain that none is going now.

AUSTRALIAN MINING.

The value of the output of minerals in Australia last year was £26,279,000, or £215,300 above the figures for 1912. The total is very satisfactory, for while there was a fairly high range of prices for tin and lead during the year, the price of spelter was on a lower level, and there was a decline in the price of copper. The gold total, which amounted to £9,363,300, showed little variation from the figures of 1912. The coal output amounted to £4,627,500, silver-lead to £5,253,900 and copper to £3,266,100. New South Wales was the greatest producer of minerals among the States of the Commonwealth, its total being £12,095,100. Next came Western Australia with £6,036,200. The Broken Hill field remained as the great dividend-producing centre of Australia.—London Financier.

According to Mr. A. C. Dennis, superintendent for the contractors a new world's record for tunnel boring was established in November in connection with the work being done in the Roger's Pass for the C. P. R. by the contractors, Messrs. Foley Bros., Welch and Stewart.

Mr. Dennis reports that last month 817 ft. of the "pioneer" heading—the preliminary shaft running parallel to the main passage, from which operations are directed at several points—was excavated. The American record for a month's tunnel boring was 810 ft. in 31 days.

As a result of the rapid progress now being made with the tunnelling operations, the contractors are now confident that they will put the Rogers Pass tunnel through several months earlier than their contract with the Canadian Pacific calls for. The five-mile, double-tracked passage through the base of Mount Macdonald is to be ready according to the terms of the firm's agreement, by the end of 1916. At the present rate of projection it is estimated that the tunnel will be completed in the summer of 1916.

There remains 16,000 ft. of the "pioneer" shaft yet to be driven, 10,640 ft. having already been bored. At the west end of construction, 817 ft. of the preliminary shaft, and 640 ft. of the main passage was excavated last month, and from the eastern portal 527 ft. of the former and 588 ft. of the latter. Although the work has been well advanced, the hardest part of the actual boring has yet to be done.

PERSISTENCE OF ORE IN DEPTH

At the second general meeting of the twenty-fourth session of the Institution of Mining and Metallurgy, held in London, on Dec. 17, 1914, there was a discussion of a paper entitled "Persistence of Ore in Depth," presented by T. A. Rickard.

Mr. T. A. Rickard said in part:

Twenty-eight years ago—nearly 29 years ago—I was temporarily in charge of a mine in Colorado. A letter came from London notifying me that one of the directors would pay a visit to the property, which was owned by an English company. At once I realized the importance of the occasion. I assumed, of course, being ignorant of joint stock finance, that a director must be a man of unusual sagacity, with special knowledge of mining. Else wherefore was he selected as a director? When he arrived, I found him to be a wise old Scot, with some knowledge of sugar plantations, but innocent as regards mining. However, I was very careful of my p's and q's, desiring to create a favorable impression. The day after his arrival we went to see one of the mines. As we proceeded leisurely on quiet horses up Virginia canyon, from Idaho Springs towards Central City, he noticed the prospect holes on the adjoining hillside. "What are those?" he asked. I told him that they were excavations made by miners in the search for ore. "Why did they stop work?" he queried. "Because the ore did not last," I replied. "Could the ore in our mines come to an end in depth?" "Certainly,"said I. Whereupon he relapsed into silence. This was his first contact with a basic fact in mining. And to tell the truth, his question had also made me aware how thin was the smooth ice of optimism on which our enterprise was skating. Later, while we enjoyed an excellent pasty provided by the Cornish superintendent, he questioned me concerning the origin of ore. Having discovered that the old gentleman was at my mercy, I proceeded to tell him the whole story from the geological dawn to that sunny noon on the Rocky Mountains. Not being hampered by too many facts, I was well able to discourse on this fascinating subject. That was long ago; if any canny Scot were to ask me now to tell him how ore is formed, I should answer with the hesitation that comes to us when we have learned to realize the limits of ascertainable fact.

The subject of ore persistence is vital. As the whole philosophy of life is colored by a recognition of our physical mortality, so the operations of the miner must be conditioned on some definite notion concerning the continuance of his orebody. I submit to you that for a mining engineer to undertake the appraisal or equipment of a mine without a clear idea concerning the probable persistence of ore in mines generally is as unwise as it would be for an actuary to prepare a policy of life-insurance without a definite notion concerning the average longevity of human beings. The problem of ore persistence must be faced frankly and fearlessly. We must face it in the light of facts—the bright glare of realities not the rosy twilight of agreeable hypothesis or the dense fog of flamboyant expectations.

The enrichment of ore in depth has been consigned to the limbo of discarded fallacies; the generalization that ore persists indefinitely in depth must join it. Geologists may prove to their satisfaction that the deepest mine workings are relatively shallow and that the question of depth in itself is rendered supererogatory by the miles of erosion to which the ore bearing rocks have been subjected. But such academic arguments are only confusing.

I can imagine that a clever physiologist might bring forward an argument to prove that if the human body were carefully conserved, if shocks and excesses were avoided, if food and climate were carefully chosen, and if every organ were given adequate and regular exercise, a human being would be capable of living to 250 years. It would be interesting; but I should take my academic friend to the nearest cemetery and point to the dates of arrival and departure upon the truthful tombstone; I should quote the psalmist's dictum concerning "three score years and ten," and I should introduce my learned theorist to an actuary, who would tell him that as a matter of insurance business the average expectation of life is only 45 years, and the maximum one century. I should treat his brilliant argument as an intellectual feat and offer him the sedative of a cigar.

To assert the indefinite persistence of ore is to assume the inexhaustibility of ore deposits. Is history to be disregarded? Greece obtained her silver from Laurium as long ago as the Peloponnesian war; Hannibal drew money for his campaigns from the gold mines of Iberia; the Roman emperors took tribute from the gold mines of Dacia; the ancient world derived its copper from the Sinai peninsula, and so forth. Of these mines, in most cases, only the memory remains.

Is that an unpractical test? Then I turn to the share list of mines quoted on the London Stock Exchange at the date when my first article on this subject was published, namely, January 21, 1893, nearly 22 years ago. In the Financial Times of that day I find a list of the mines that were then the subject of joint stock speculation. Out of 250 companies then quoted, only a quarter have survived. Out of 22 British mines, only seven have been continuously operated, and each one of these has gone through phases of reconstruction and recapitalization; 15 are dead as mutton. Out of the 76 South African mines, 30 have succumbed, chiefly diamond ventures and gold enterprises on the outskirts of the Rand. As the Rand is practically one lode, the discontinuance of an individual mine is inconclusive. On the miscellaneous list there were 160, of which number only 23 are now doing business, and of those five have suffered reconstruction. Among the casualties are half a dozen Mysore "pups," for in 1893 Indian mining was enjoying a boom. The list also includes a number of mines once famous; for example, El Callao, Richmond Consolidated, Emma, Montana, Elkhorn, Guston, Yankee Girl, Old Lout, Poorman, Maid of Erin, Mammoth Gold, Amador Gold, Sierra Buttes, Linares, Alamillos, Victory, Darien, Copiapo, Tetuan, Mesquital del Oro and Kapanga. I give the names just to remind some of you of the vanished dreams of a bygone day. To talk about persistence in depth in such a context is like asseverating physical immortality to the compiler of a biographical dictionary. Not that biographical dictionaries are necessarily depressing; in their stories of great achievement and high endeavor they stimulate and encourage a later generation. Of the mines mentioned, the majority yielded fortunes to their happy owners, and the minority that entailed loss on their shareholders did so chiefly through such unjustifiable exaggeration of their productivity as was due to an erroneous assumption of inexhaustibility based on the idea of indefinite persistence of ore in depth. Fortunately we forget our foozles in mining as in golf. Jas. D. Hague, one of the wisest of mining men, said long ago that mines are like saints, "for many are called and few are chosen." The chosen wear a halo.

It will be said by some worthy people that the insistence upon unpleasant realities is hurtful to mining speculation and of no particular advantage to the industry. Leaving the proud platform of the scientific man, scorning all intellectual dishonesty, let me reply on the sandy floor of workaday commercialism, by insisting that the capital available for mining is limited, and that the more of it that is squandered over wild goose chases or will-of-the-wisps, the less of it will there be for intelligent enterprise. When money is furnished for foolish ventures, the industry suffers by disgusting or disappointing those who would otherwise participate in reasonable projects. An example of recent date may be quoted.

In January of this year a description of the Kirkland Lake district was published in the daily press, in advance of the prospectus of a company, the shares of which were subsequently the sport of excited gambling. In that description it was stated in pseudo-scientific language that "the volcanic activities which resulted in the mineralization of Ontario took place subsequent to the denudation of the Laurentian mountains by glaciers," and that "the volcanic material, which contains the minerals, has everywhere been forced upward through the sedimentary and glacial deposits." Then comes the inference: "This indicates with certainty that the mineral bearing veins will be found to persist to great depths." And "great depths" is further defined as "only limited by physical obstacles to economic working." Here is the old fallacy, decked more decorously than of yore, but unchanged in its insidious mendacity. In sheer bravado the scribe, hired by a company promoter, asserts that "this would appear to be especially true of the silver deposits at Cobalt and the gold bearing veins of Kirkland Lake and Porcupine."

As the deepest ore disclosed at Kirkland Lake was only 300 ft. deep and the deepest at Porcupine only 450 ft. from surface at the time this was published, the prophecy, for it is only that, may wait for proof or disproof, save on general grounds as something contrary to experience; but of Cobalt it can be stated that the economic geology of that rich silver district is sufficiently known to warrant a categorical denial of persistence to "great depths." Facts disclosed by mining and inferences made by experienced geologists unite in proving that the veins of Cobalt extend into the Huronian conglomerate for a limited vertical distance above and below a sill of diabase where that diabase is relatively near the present surface. (These statements are not true to-day.—Ed.)

When the ore bearing veins pass out of the conglomerate or the diabase into the underlying Keewatin schist, they become unproductive, regardless of depth. Moreover, these are not the only mining localities in that part of the world. The Rainy Lake, Wabigoon and Lake of the Woods districts have had their day, and it was as short as the persistence of their ore was brief. Cobalt has done well, despite relative non-persistence in depth, and affords ample opportunity yet for productive exploitation within known vertical limits. Porcupine and Kirkland Lake, we may hope, will become important goldfields, but it remains to be proved, in one way only, by actual mining, how deeply the ore persists.

Meanwhile, no scientific fact warrants and no experience justifies the confident assertion of a persistence to depths that will test the mechanical ingenuity of the miner. Of course, such ignorant assertions as above quoted have nothing to do with economic geology, but they have a great deal to do with methods for debauching our profession, for exciting the greed of the unwary, and transferring the earnings of the many to the pockets of the few.

The subject is one that must come home to all of you. Each of you must have some opinion upon it, according to your observation and experience. It is well that you should contribute out of your store of personal knowledge, so that we may arrive at a settlement of this vexed problem.

You need not fear that the truth will hurt legitimate mining. On facts science is built and on the application of science mining is based. No legitimate industry can prosper on make-believe; no profession can command confidence so long as its reckless optimism is flouted by the realities of experience. If the mining industry is to flourish and to receive public support it is for us—for you and me—to enlighten those who furnish the capital; to divert such capital from unproductive channels to those likely to be productive; to render the employment of money safer and more profitable.

To discard make-believe is not to become pessimistic. That the miner never is, so long as he remains a miner. But sane hopefulness must not degenerate into crazy optimism. In mining, as in life, to accomplish anything we require the cheerful forward glance; but in mining, as in life, credulity leads only to disaster.

The discipline of facts must control the constructive imagination of the engineer, so that mining as an art, regulated by science, may become the safe basis of beneficent industry.

It is high time that an unsubstantial generalization should cease to provide material for flamboyant prospectuses and irresponsible promoters. It is high time that mining engineers should dissociate themselves from pseudo-scientific fallacies masquerading as scientific truths. That is why I have taken the pains to collect data and to marshal arguments in the hope of disproving once and for all that the indefinite persistence of ore in depth is neither a fact nor a theory in economic geology.

The president, **Dr. F. H. Hatch**, said that the subject of Mr. Rickard's paper was of the greatest importance, seeing that the life of most mines was chiefly determined by the downward limitation of the orebodies to the exploration and exploitation of which the mining man directed his energies. Strange as it might appear, it was not always easy to ascertain from the published returns of a mine whether the average metallic content of an orebody was diminishing or not as depth was attained.

Improvements in the methods of mining, of handling and of treating the ore were continually effecting a reduction in the working cost of a given mine; consequently, ore of lower and lower grade could be treated profitably. Thus it came about that rock which at an earlier period of the operations was rejected as "waste" was at a later stage a valuable material for treatment. In consequence, a lower average yield did not necessarily mean a falling off in grade due to increased depth.

It was true that by systematic sampling and recording of results on a suitably devised assay plan, variations in the metallic content of an orebody from level to level were disclosed; and it was by those means that the cardinal fact as to whether there was or was not an impoverishment with increasing depth could always

be established, provided of course that it really was desired to ascertain the true conditions, whether they proved palatable or not.

Mr. W. H. Trewartha-James expressed his very great pleasure to congratulate alike the president, the Institution and the author upon the brilliant presentation of the paper, which was remarkable from two or three different points of view; the great ability and the great width of research shown in marshalling and collecting the facts; the rugged and outspoken honesty of purpose, which was self-obvious; and although the author pointed out that the question of the impoverishment of orebodies in depth had previously been lightly discussed, this was the first occasion on which a definite theory had been presented in such a form. Undoubtedly most of them had long been aware of this great truth, and had realized it in different degrees as the result of their experience, yet none of them had ever dared to put forward on such a strong basis the material fact which must now be accepted by the profession for the future.

The title of the paper itself was a model of terseness, but it did not disclose the positive conclusion which the author intended to formulate, though the subject-matter left no doubt thereon. He could have wished, however, that the author had stated in the paper, as no doubt he would state in reply, exactly what his positive attitude was, because upon the terms of that statement depended very materially the final acceptance of the theory.

He thought that the facts, that had been arrayed so logically, showed that in the great majority of cases the metalliferous "ores" in lodes and veins do not and cannot be expected to persist to absolutely indefinite depths. But the word "depth" was, as the author had pointed out, such a relative term that the speaker clearly saw a danger in placing a wrong interpretation on this word, and in the acceptance of the theory of ultimate impoverishment at depth without reservation, for the word "depth," which was the gist of the paper, entirely begged the question of precise definition.

He understood the author contended that depth, and depth alone, was the material consideration which had to be taken into account, whilst the speaker held that structural geology must form the basis for consideration.

With regard to the "forlorn hope" of which the author spoke, he could give a remarkable instance from his personal experience, the case of the Britannia mines in Howe Sound, British Columbia.

The company had been exploiting those mines for a number of years, and had spent something like $3,000,000 without any profit to themselves; the material which they were mining was not ore, but a mineral aggregate. A very clever man, whom no doubt the author knew, Mr. Schley, of New York, from long study of the subject in all its details as they affected the Britannia mines, had arrived at the conclusion that before he abandoned the mine he would put in two or three adit levels at considerable depth beneath the great orebodies which they had not been able to work profitably above, and of which large quantities of available tonnage remained.

He desired to pay one of the highest tributes that could be paid to the engineer in charge of these mines, as he declined to be responsible for driving these deep tunnels, and resigned his post because he saw no prospect of attaining a useful object thereby.

The result of that exploitation at depth he thought they probably all knew. The Britannia mine to-day was one of the most remarkable mines on the West Coast, one of the great profitable producers of copper, and that "forlorn hope" had become of the utmost importance, not only to that company, not only to that district, but to the whole science and art of mining on the Pacific Coast.

He trusted he had made it perfectly clear that he accepted the author's main contention that metalliferous ores in lodes and veins do not continue or persist to indefinite depth, or, as defined in his earlier writing, that ores do not as a rule persist in depth, much less grow richer, and on the facts as stated it appears that mining engineers as a community must do the same.

With regard, however, to the various inferences, generalizations and corollaries deducible from the main contention, there was room for considerable modification.

Professor Wm. Frecheville said he would like to commence by complimenting the author on his very interesting and stimulating paper. It was a most important subject and probably many of the members would agree in the main with the author's conclusions. Also, he thought the public—and by the public he meant the people who invested in mining ventures—largely knew that mines were uncertain, and that they were what accountants call a "wasting asset." The only people who did not acknowledge it were the Income Tax authorities, who would insist on charging the full rate on mining dividends.

In the main he thought many of the members would agree with the author, but at the same time he could not help thinking that in his keenness to prove his point the author had at times given a rather one-sided view. For instance, he quoted the Village Deep as an instance of a mine where the ground in depth was poorer than the ground immediately above it. That was quite true, but the author omitted to mention a neighboring mine, the City Deep, where the exact opposite was the case.

Then again, the author gave a diagram of the underground workings of a number of mines on the Kolar goldfield, and amongst them the Champion reef. Turning to that it would be seen that in the case of the Champion reef the lode at the 2,000 ft. level had been more productive than it was at the 1,000 ft. level; more ore had evidently been stoped out. If that improvement in depth could take place at 2,000 ft., why not at 3,000 ft., or 4,000 ft.? Why should they select an arbitrary point and say there might be improvements from 1,000 ft. to 2,000 ft., but not from 2,000 ft. to 3,000 ft.

Again, the author mentioned the North Star mine, and insisted that the mine had become poorer, although he acknowledged that the production per square foot had increased with depth.

The task of comparing ore ground in depth with ore ground close to the surface was a very difficult one, because they all knew that ore deposits were patchy. Even the ore deposits on the Rand were patchy, and they were much more so in ordinary lodes. The prospector, to start with, walked over the surface of a mine and found a payable orebody. He did not go to much expense; he made a few trenches and found it, and it gave him a clue to follow in depth, and he followed it. But what was his position when he got down to a considerable depth and those orebodies began to fail, as they knew orebodies always would fail? If the prospector wanted to prospect he had to work laboriously and slowly in the dark and at great expense; he was seriously handicapped. They knew there were

blind shoots, that is, shoots coming in in depth which did not go to the surface, and the inference was justified that in many mines there were other orebodies, other patches, which were never brought to light.

Most people would probably agree with the author that too little lateral prospecting was done as a rule. In ground which was highly mineralized the chances of finding other parallel deposits, or other deposits on the extension, were probably not always sufficiently realized.

In conclusion, in spite of what the author had brought forward, he thought that miners would continue, when they had encouragement, to sink, in the hope that they might find a recurrence of good values, or other orebodies, such as those to which the author had drawn attention in the North Star and other mines.

Mr. E. T. McCarthy regarded the subject as of the highest importance, although one that was open to a great deal of criticism, because the factors concerned in it were so various, so complex, so overlapping and so interwoven with each other, that it was difficult to draw any certain deductions from them. Yet the author had made out a very strong case in support of his contention by the facts he had marshalled in favor of the question of persistence of ore in depth.

As the author stated, the question was a comparative one. He believed that the depths of veins, or of a series of lens-like fissures, had some relation to the length, strength and structure found along their strike, or lateral extension at or near surface. For example, if he found the outcrop of a vein continuing all round the globe, only then would he expect it to go down indefinitely in depth, or until it ended at the centre of gravity.

Again, there was the question of veins now being worked at depths that must originally have been great. For example, let them take a series of lens-like orebodies becoming enriched as they approached an underlying contact rock, as in the Porcupine district of Canada; there they found orebodies existing which in all probability had been formed long before the Glacial Epoch had swept away their upper portions, and at a far greater depth than would be workable at present had the original surface been maintained. In Siberia the Russian geologists considered that some of the present known ore deposits were formed at a time when many thousands of feet existed above their present level, which had since been denuded until the great Steppe Plains, in which they were found, were now reduced to a comparatively almost dead level.

If those were right assumptions, it would go to prove that ore fissures of one sort and another might exist at almost any horizon below the present surface of the earth, and that depth in itself had nothing to do with their persistence, but had rather to do with some relation between the lateral extent, strength and structure of the fissuring, and was relative to that and not to the present ground surface. But when one came to the persistence of the ore itself in depth, relative to any particular fissure, after the upper or enrichment zone had been passed through (which latter, so far as they knew, occurred only in those veins which had been subject to decomposition where they had reached the surface), one was met with much more complex problems. Where, on the other hand, great homogeneity of the country rock could be determined, through which the fissure passed, a greater continuity of mineralization in depth might be expected than where the reverse occurred.

Mr. H. W. Turner said with regard to ore giving out in depth, the author could recollect that in the early history of Kennedy mine, on the Mother Lode in California, on about two levels there was no profit. The mine was then closed down for some little time, and that would have been the end of it if no one had had any belief in deep mining. As those interested in that part of the country were aware, it was taken up again, and they had now gone down about 4,000 ft. vertically, and had found excellent ore in the bottom.

The Empire mine, in Grass Valley, was another example. This property being in private hands, there were no public reports, but he was credibly informed that about the time the present chief owner, Mr. W. B. Bourn, took hold of the property, a level was run that was nearly barren, and this was perhaps the thirteenth level on which the vein split up into branches. Nevertheless, below the ore came in again, and it is now one of the really good mines in the Grass Valley district, and said to be about 4,000 ft. deep on the incline.

Mr. W. McDermott said that what they had heard already had been so highly interesting that upon the main subject of the paper he had nothing to add, because he thought all those who had much experience would agree that there were a painful number of instances of mines which rapidly got no better with depth. However, he thought the author's general conclusions might make some people a little more despondent than there was any necessity for; because even within the profitable depths which had been attained, of the good margin from 150 ft. to 5,000 ft.—there were plenty of opportunities for the mining engineer.

It must be a great consolation also to consider what a merciful dispensation of Providence it was that the poor ends of mines were not stuck up in the air. It seemed to have been specially arranged the other way for the benefit of the profession of the mining engineer, giving an encouragement to start from the surface; and also hopefulness, so that capital was obtainable to back up hope as to persistence in depth in that particular case in which each man was personally interested.

CROWN RESERVE.

Crown Reserve's next dividend will be at the monthly rate of 2 per cent., and will be payable on January 15. It is expected that early in the month the directors will come to their decision with regard to the reduction in the dividend rate, and that the next announcement will be at the new rate, presumably 1 per cent. It is said that Col. Carson, president of the company, who has been in England superintending the movement of the Canadian contingent, will return to Montreal for the annual meeting.

HEDLEY GOLD MINING CO.

Hedley Gold Mining Co. has declared a quarterly dividend of three per cent. and an additional dividend of seven per cent. on the outstanding capital of the company, payable Thursday, December 31, 1914, to stockholders of record December 26, 1914. The earnings for this year will be somewhat less than last year, although sufficient to maintain last year's dividend rate of 30 per cent. In view of the heavy outlay for the new power plant and the increased inventory of supplies from abroad, provided to protect us from interruption by the war, the directors deem it wise to reduce the total dividend for 1914 to 25 per cent.

THE ALBERTA OIL FIELDS*

By E. H. Cunningham Craig.

In spite of the amount of actual drilling that has been done in the last few months, it cannot yet be said that the Calgary field is proved.

The first well of the Calgary Petroleum Products Company (the "Discovery Well")) continues to produce the same very light oil, but not in the large quantity of which optimists claimed it was capable. The gas pressure remains very strong, however, and the company's second well has progressed steadily and is yielding gas under very high pressure. Its prospects of proving to be an oil well are distinctly good.

Several other companies working in the immediate neighborhood have also struck gas.

Between thirty and forty wells are now drilling, and a very wide area is being tested—from the Athabaska River north of Fort McKay to the International Boundary—while many other companies intend to begin active work shortly.

Benton Shales (not the Bearpaw) and has reached and found oil in the Kootanie. This theory necessitates the presence of a great unmapped fault eastward of the well, and it is difficult to reconcile such an idea with the stratigraphical work done by the Geological Survey and other observers. Yet it cannot be said that it is beyond the bounds of possibility, and should it be finally proved it will assuredly enhance the prospects of those wells drilled on western flexures to reach the Kootanie rocks.

Confidence in the prospects of the field is yet unabated, though inflated prices of stocks are now a thing of the past, most of the shares of companies being quoted at what are approximately their intrinsic values. There is reason for this confidence, however: every company that has drilled into the Dakota formation has had signs or slight shows of oil and gas, and these from strata so calcareous and close-grained that they are incapable of containing more than minute quantities of hydrocarbons. In one or two cases these shows have continued for hundreds of feet, now increasing slightly, and again decreasing.

OKOTOKS, CALGARY OIL FIELD, ALBERTA

This activity, though saying much for the enterprise of the various companies, is to be deprecated, since a dozen wells carefully located might be quite sufficient to test all the different areas and different conditions in the Province.

Many, indeed most, of the wells are predoomed to failure on account of the absence of favorable geological structure, and some even quite near the Discovery Wells are situated too far to east or west of the crest of the anticline to have any great hope of proving productive.

The depth to be drilled in most cases has proved greater than was anticipated, noticeably in the case of the United Oils of Alberta and the British Alberta Oil Company, which are testing anticlines lying to the westward of that on which the Discovery Well is situated. The principal cause of this is unprecedented thickening-out of the Dakota Formation. No well has yet reached the Kootanie strata under really favorable geological conditions.

A theory based upon fossil evidence, which may or may not be adequate, has recently been put forward to the effect that the Discovery Well really begins in the

The Calgary Alberta Oil Company, drilling in a western anticline, where the Dakota rocks come very near the surface, have had a show of oil in Dakota strata at little over 200 ft., and as the flexure in this case lies on a more westerly line of strike than is being tested by any other company, the show is certainly significant.

A good show of dark-brown oil of 45 (Beaume) gravity has lately been announced by the Southern Alberta Oil Co. at a depth of 2,200 ft. The company's well is about a mile to the northward of the Dingman or Discovery Well, and it seems possible that this may indicate the quality of oil that may be expected when the source of the filtered oil struck in the Discovery Well is reached.

The only important point to be noted in connection with all these occurrences is that the oil-bearing stage has been reached in strata above those in which the actual production is looked for. This in itself is suffi-

*From the Petroleum World.

cient to justify much of the development work that is being done, and to suggest that there may be excellent results when the Kootanie horizon is reached.

Of other companies testing strata higher in the Cretaceous series there is little to tell. The Monarch Oil Company has drilled to some 3,500 ft. and has had shows of both gas and oil at several horizons, beginning in the Edmonton formation. The Dome Oil Company is also credited with having encountered gas among the higher horizons, but as yet there is no definite and reliable evidence from the Alberta field that commercial production can be obtained from any strata above the Claggett shales.

Further westward and northward more than one prospecting party has been making exploration. In all these cases, however, it is to be feared that the fields are somewhat shallow, and that the best oils obtained are merely filtered residues which exude slowly from strata older than the oil-bearing series, but which have been impregnated from it. Such anticlines as have been delineated seem to be too broad and gentle to have had great effects in concentrating heavy petroleum to a sufficient extent. A vast field still remains for prospecting guided by scientific methods, and when transport facilities are better than at present it is possible that these northern and north-western fields may be able to show sufficient inducements to attract capital for their development.

Unloading oil well Supplies at Okotoks, Alberta

Transporting oil well supplies in Alberta

Oil-shows and gas-shows both at outcrop and in wells from younger strata are numerous, and it may be necessary to collect and deal with such evidence at no distant date, but for the present the fact remains that no production on a commercial scale can be brought forward as proof that geological structures are sufficiently favorable to warrant extreme prospecting by the drill in these younger formations.

In Northern areas, e.g., the Athabaska, Peace, and Mackenzie rivers, prospecting work has been active during the summer, and samples of very good oil have been brought from many widely separated localities.

Athabaska Oils, Ltd., under new management, has continued the work of prospecting the "tar-sand" area north of Fort McKay, and thick heavy oil, yielding however a large percentage of light oils on distillation, has been obtained in small quantities.

The Sweet-grass country on the International boundary has attracted considerable attention, and several wells are now being drilled. The old Lineham well has been re-opened and samples of excellent brown oil of approximately 40 (Beaume) gravity from it have been on exhibition, but no statement as to what production can be counted upon has been made.

In the course of the summer many experts and quasi-experts both from the Uunted States and Great Britain have visited the various fields and have spent days or even weeks in examination of the geological conditions and of the drilling wells.

Some have unhesitatingly condemned the fields, though whether upon sufficient grounds or not it has been difficult to discover. Some have been merely

"Boosters" upon grounds equally obscure. Some, and it is noteworthy that the best known experts from the United States come under this category, have come, seen, said little or nothing, and departed.

Generally speaking, it may be said that the definiteness of the pronouncement in each case has been in inverse ratio to the geological knowledge of the expert.

Still, as mentioned above, the tone in Calgary of those most deeply interested is one of quiet and cautious confidence. Dealing specially with the fields within sixty miles of Calgary, it cannot be said that any undoubted proof of the presence of an oil field can be claimed. A certain measure of success is indicated by the Discovery Well, but much has yet to be proved. The oil-bearing stage has been reached in the strata, as was predicted on theoretical grounds. That is certain, but whether a production of petroleum on a commercial scale can be counted upon or not still remains unsettled.

There may be a great oil field, or there may not, but only the drill can decide this question.

AMALGAMATED COPPER.

In an interview at Great Falls, Mont., last week John D. Ryan, president of the Amalgamated Copper Co., and B. B. Thayer, president of the Anaconda Copper Mining Co. who are on a tour of inspection in the West, had the following to say:—

"There has been some report that it is the intention of the Anaconda Copper Mining Co, to abandon Great Falls and practically close the Boston & Montana smelter. You may say as strongly as you can that there is no foundation for that rumor. We propose rather to enlarge the investment here materially, and the payroll at Great Falls, when the plans have been developed, will be very much increased. The refinery which we shall build in the general scheme of enlarged activities of the Amalgamated will represent more than $1,000,000 investment. The investment caused by the general expansion and preparation to handle the business of the future by our company will mean a material increase in the copper industry of Montana. Great Falls can have no fear about the Amalgamated withdrawing from this city. There is no ground for such rumors.

"We are studying the question as it applies to our entire interest, but are unable to say at this moment in what particulars this development will be effected. We will visit all of the properties in the state, and after fully sizing up the situation expect to adopt a policy of enlargement upon which work will be started just as soon as the proper time is deemed to have arrived.

"Among the propositions we have in mind and which we hope to carry into effect, will be the elevating of the Black Eagle dam at the Boston & Montana smelter for the production of an increased power. We also expect to make substantial improvements to the refinery department at the Boston & Montana smelter, together with other minor improvements to the plant which will bring it up to a high standard. It has been determined to do this construction and improvement work during the time the plant shall remain idle, as it can then be effected at a great saving under the cost during the plant's operation.

"Money conditions have greatly improved, and the matter of financing this proposed work will be far less troublesome than it would have been a few weeks or months ago. However, until we have visited the other plants in the state and have gone into the details fully we will not be able to announce our plans definitely, preferring to act upon the matter as a whole."

PERSONAL AND GENERAL

Mr. W. P. Alderson, formerly of the Hollinger Co.'s staff, Porcupine, but now general manager for the Motherlode Sheep Creek Mining Co., operating a gold mine and stamp mill in Sheep Creek camp, Nelson mining division of British Columbia, left Nelson on December 13 on a visit to Toronto.

Mr. Clifford E. Smith, Toronto, has been elected a governor of the School of Mining, Queen's University, succeeding Hon. Wm. Harty who retires after many years of service on the Board.

Mr. Gerald Galt has joined the staff of the Braden Copper Co.

Messrs. E. LeRoy, G. C. MacKenzie, John McLeish and E. Lindeman of Ottawa, spent a week in Toronto during December, gathering information on the iron industry in Ontario for the Department of Mines.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Dec. 19, 1914. The next meeting will be on Jan 9, 1915.

Mr. C. J. Seymour Baker, long engaged in making investigations and tests in connection with the occurrence of gold-quartz ores in Cariboo district of British Columbia, recently spent a few days in Rossland camp.

Mr. J. C. Drewry, for years officially connected with the mining company, formerly owning part of what is now the St. Eugene group of claims at Moyie, East Kootenay, and other mining properties in British Columbia, has been seriously ill at his home at Cowley, Southwest Alberta.

Mr. F. Chas. Merry, superintendent for the Ferguson Mines, Ltd., operating in the Lardeau district of British Columbia, is retiring from that position and leaving the district.

Mr. Dudley Michel, of the British Columbia Department of Mines, who is organizer of classes for instruction in "first aid to the injured" among men employed at metalliferous mines in the province, recently organized a class at Anyox, Observatory Inlet, in the neighborhood of which place is situated the Granby Co.'s Hidden Creek copper mine and the company's new smelting works. He went thence to the Silver Standard mine near Hazelton, Skeena district. He will shortly visit the Britannia Co.'s property, near Howe sound, Vancouver mining division, with the object of interesting miners there in first aid instruction.

Mr. R. S. Ord, of Spokane, Washington, is now general manager for the Corbin Coal and Coke Co., which operates coal mines in the Crows Nest district, Southeast Kottenay, B.C. For some years Mr. E. Roberts, also of Spokane, managed this company's office affairs, but other duties as superintendent of the Corbin railway out of Spokane to British Columbia require all his time, hence his retirement from the coal mining company.

Mr. Frank A. Ross, who was general manager of the Nickel Plate mine and stamp mill at Hedley, B.C., for the executors of the estate of the late Marcus Daly to the time of the sale of that gold producing property to the men who organized the Hedley Gold Mining Co., has been elected president of the Columbia Local Section of the American Institute of Mining Engineers, with headquarters in Spokane, Washington.

Mr. R. H. Stewart, of Trail, B.C., general manager for the Consolidated Mining and Smelting Company of Canada, Ltd., has been in Toronto in connection with the company's annual meeting of shareholders.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA, SOUTH LORRAIN

Buffalo.—Normal conditions have been resumed at the Buffalo mines after being closed down or running with a greatly reduced force since the beginning of the year.

The Buffalo has always ranked as one of the largest mines in the camp, and the resumption of operations has greatly increased confidence that the crisis in the silver market is over. In the second or third week in August the Buffalo closed down underground operations, and some weeks later the mills. Since then a few men had been put on, until there was a force of about 75 employed. On the dicision to resume operations, one hundred men were hired, and the mine and low grade mill are in full swing. It is understood that underground work at the Buffalo during the past six or eight months has been quite satisfactory in adding to the reserves blocked out and indicated a good tonnage of low grade ore. For the present the high grade mill will not be operated, and the concentrates from the low grade mill will be stored.

Nipissing.—The better condition of the silver market is reflected in the fact that the Nipissing has commenced to release a good quantity of its stored bullion. Other companies are following suit, and the shipments during the last two weeks of the year should be high.

McKinley-Darragh-Savage directors decided to pay the regular dividend of 3 per cent. on Jan. 1st. This will be the third dividend without bonus. The McKinley will, on Jan. 1, have paid 196 per cent., or $4,404,708.

No new ore bodies have been found on the McKinley-Darragh itself within the past three or four months. On the new discovery at the Savage, a drift is now being run at the 200 ft. level, and both faces are still in remarkable ore.

Chambers-Ferland.—There is considerable interest and speculation as to the probable or possible results from the exploration work undertaken by the Chambers-Ferland and the La Rose in their new shafts to the north-west of the Nipissing. This particular area of conglomerate has always been regarded as most probable to yield profitable results from exploration. Nothing definite has been found on either property to date, but there has been much excitement among Chambers-Ferland stockholders, owing to the report that their crosscut was now nearing the point where it should intersect a vein worked almost to the boundary of their property on the Nipissing. The shaft on the La Rose is now down to a depth of 150 ft. and is still in conglomerate. The first station will be cut at 200 ft., but little exploration work will be undertaken until the contact has been reached, as development on the adjoining Nipissing has shown that the best grade of ore is most likely to be found in the conglomerate for a hundred or a hundred and fifty feet above the contact.

November shipments of ore from the Cobalt camp were slightly higher than for the preceding month. Bullion shipments for the same period were very much lower. Thirteen mines shipped 1,366 tons.

The Mining Corporation of Canada, which includes the City of Cobalt, the Cobalt Townsite, and the Cobalt Lake, was easily the heaviest shipper. Their contributions to the ore list have been growing perceptibly during the latter part of the year. All ore is now being hoisted from the City of Cobalt and the Cobalt Townsite through the new main working shaft and after being picked sent direct to the mill. Upon the mill a wing is now being built for the installation of a plant to cyanide the slimes.

Nipissing.—During November the Nipissing mines shipped nothing, neither ore nor bullion. Nipissing mined ore of an estimated net value of $189,029. As stated above, the company has resumed bullion shipments to England this month.

Interesting results were obtained in putting down winzes to discover the depth of the contact below the fourth level at shaft 73. The first winze found the contact at 45 ft., another 150 ft. to the east is still in good conglomerate at 28 ft. on a vein 2 in., assaying 2,500 oz. As soon as the information on the exact whereabouts of the Keewatin contact is complete, the fifth level will be started.

At shaft 64 a winze put down on the vein at the 900 ft. level shows no improvement in the silver contents of the lead. During the last month the hydraulic was working on the surface five veins were uncovered. During November a drill was put to work open cutting three of the better of these veins. The most favorable has a width of 2 in., of 2,000 oz. ore, for a length of 40 ft. During the month of November the three open cuts yielded 10,385 oz. in silver.

During the past season 95.6 acres were washed of overburden.

PORCUPINE AND KIRKLAND LAKE

Hollinger.—A contract has just been let for ten additional stamps at the Hollinger mine. These stamps should be ready to drop by the end of March, as work on the excavations has already been commenced. The three big compressors in the new power house on Gillies Lake are now complete and running.

Jupiter.—The McKinley-Darragh-Savage Company of Cobalt has definitely decided to throw up the option on the Jupiter mine. The three months' extension of the option expired on Dec. 17th.

Under this option the McKinley-Darragh was required to pay off the bonds amounting to $50,000, and to buy control of the stock at a price amounting to 13 cents a share, and to continue development. After a conference at the mine and in Toronto it was definitely decided to throw up the option and the machinery belonging to the McKinley has been taken out of the mine and shipped back to Cobalt.

There is no doubt that the mine has responded to development; but the ore shoots are claimed to be too short on the various levels to allow of a profit commensurate with the risk taken by the company in taking up the option. The ore shoot on the vein at the 475 ft. level as developed showed a very good grade of ore right across the face of the drift.

The Jupiter Company sent its president, Mr. Brigstocke, to examine the mine, with the result that it has been determined to keep it pumped out for the present. It is rumored that the company is endeavoring to arrange for the future development of the mine itself.

Dome.—Very considerable difficulty has been obtained in fulfilling the terms of diamond drill contract at the Dome. It was stipulated in the original agreement that at a depth of 1,000 ft. the drill should be within a radius of a 50 ft. from the vertical. Not much

progress had been made, as the terms of the contract could not be complied with, and a trial was given to another contractor. The attempt was not a success.

Alexo.—Since operations were resumed at the Alexo mine, near Porquis Junction, nine cars of ore have been shipped. The total for the month of November was 622,600 lb. of nickel ore. This is all going to the Mond nickel smelter at Coniston.

Sesikinika.—A find of some importance has been made on the claims of the Canadian Gold and Silver Mines at Sesikinika. It has been traced across the border to the townsite of Sesikinika. The discovery was made in the course of clearing land to comply with settlement duties some ten days ago, and has made a little stir in the community.

The Huronian-Belt syndicate has till the first of January in which to start operations on the Murray Mogridge claims at Wolf Lake, if it wishes to exercise its option on these claims.

Bonus to employees.—Several mines in the camp are continuing their practice of paying a bonus to miners for "loyal service." The Hollinger has long adopted this system, and a certain percentage is set aside every month for this purpose. The Porcupine Crown has now adopted the principle, and at the end of the year will pay all employees who have been on the pay roll for three months a bonus of 5 per cent. of their wages during the year.

Vipond.—Mr. H. C. Poirier, manager of the Vipond Porcupine gold mines, has returned to New York after a stay in the camp of several months. The mill at the Vipond is now running smoothly, and a good extraction is being made. The New York consulting firm, of which Mr. Poirier is a partner, has secured an important contract in Virginia, and after a short stay in New York Mr. Poirier will go to Virginia to supervise the work there. The contract is for shaft sinking on a sulphur property.

Acme.—Some very rich ore is now being mined at one of the shafts of the Acme gold mines. Before the twenty stamps in the Acme mill are ready to drop, there will be no less than sixty faces in ore on the Acme property to work upon. The development of the Acme property is showing very remarkable results.

Porcupine Crown.—Operations at the 500 ft. level of the Porcupine Crown mine have been very reassuring of late. A crosscut has now picked up what appears to be the vein, and although it is not as high grade nor as wide as at the upper levels, it is yet so much better than anything that has been discovered before at this level, that it is very assuring.

BRITISH COLUMBIA

East Kootenay.

There has been an improvement in the situation as it affects the Crow's Nest Pass Coal Co.'s operations in the Crowsnest district, for it has been announced that the Great Northern Railway has increased its order for coal for locomotive use within reasonable distance of this coalfield, and the resumption of operations at the Granby Co.'s smelting works at Grand Forks involves the supply of coke for furnace fuel. A press despatch sent from Fernie to the Nelson Daily News on December 13 follows: "The demand for coke from the Crow's Nest Pass Coal Co. in this district is increasing, and during last week 100 coke ovens were started at the company's Michel colliery. It is expected that more of the Michel ovens will be started in the near future. The coal mines here have also been working more time, and while they are producing only slightly more than one-third of their capacity the prospect is more favorable than it was a fortnight ago. Last Saturday was the coal company's regular monthly pay day, but the effect of the improvement in working conditions will not be seen until the January pay day."

West Kootenay.

Slocan.—Ore from the Surprise mine is being concentrated at the Ivanhoe concentrator, which has been leased and put in operating order by Mr. J. P. Keane, who intends running it as a custom mill and is negotiating for ore from other mines. The Surprise has contracted to send to the mill about 1,000 tons of lead-zine ore a month. Arrangements have been made to ship the zinc concentrate to the United States, and it is expected a market will also be found for the lead concentrate.

While the Standard Silver-Lead Mining Co. has suspended ore production and closed its concentrating mill, pending a return to conditions that will leave a higher margin of profit on mine and mill products than has been obtainable during recent months, development work is being continued in the mine. No. 7 adit is now in between 4,000 and 5,000 ft., and has been in ore in places along that distance. No. 8 is also being driven, but this will be of even greater length before it will be under the big bodies of ore that were opened in levels Nos. 5, 6 and 7.

Nelson.—The Granite Poorman property, situated about half a dozen miles west of the town of Nelson, has been leased from the liquidator of the Kootenay Gold Mines, Ltd., by Mr. J. P. Swedborg, of Nelson, who has had a number of men employed getting out ore preparatory to restarting the 20-stamp mill near Granite. Before this property was sold to the above-mentioned company it was worked for years by Messrs. Gough and Guille, who took out a comparatively large quantity of gold ore.

Bad roads, now that a few inches of snow has fallen, prevent the shipment of ore from mines in the neighborhood of Salmo. Before the hauling on wheels had to be stopped for the season, zinc carbonate ore to a total of 350 tons was shipped from the H. B. and adjoining Zincton mines to Depue, Illinois. In addition, lead ore was shipped to Trail. Shipping will be resumed when more snow has fallen and a good winter road for heavy sleighs made. A new lead bearing property has been opened in this district, but it has not yet been developed sufficiently to regularly maintain shipment of ore to the smeltery.

Coast District.

Observatory Inlet.—The following excerpt from the New York special correspondence of Mining and Scientific Press may interest many readers of the Canadian Mining Journal: "Reports from the Anyox property of the Granby Company state that two furnaces are in operation and that during October 1,794,308 lb. of copper was produced, at a cost of 8c. per lb. The smelter is now making a satisfactory showing, and it is probably not generally known that this is due to George A. Guess, who is professor of metallurgy at the University of Toronto. The ore at the Anyox is so high in sulphur that it was expected that the ore could be smelted without other fuel than the sulphur. When the furnaces were blown in, however, they failed to work satisfactorily, and Mr. Guess was called upon to diagnose the trouble and point out the remedy. He found that the design and operation of the furnaces were such that it was hard to get enough air through

them for the proper conduct of operations, and by changing the character of the charge and the design of the furnace slightly, he was able to remedy this difficulty, with the good results that are shown. The incident is worth mention, since the general public belief is that college professors are more likely to get plants into trouble than to be able to remedy the mistakes of operating men." Now, without any intention to in the least detract from the value of the services rendered by Mr. Guess at the Anyox copper smeltery, it may be stated that a story current on the coast is to the effect that the breaking of a part of the ore crusher at the Granby Co.'s Hidden Creek mine (or at the smeltery at Anyox, if that is where the ore is crushed before being passed to the furnace charge bins) necessitated feeding the furnace or furnaces with ore not crushed, but of a size as sent down from the mine, and that out of this necessity came the discovery that the furnace ran more freely when fed with large-sized ore than with crushed ore. The repetition of this story does not necessarily suggest that other changes made did not contribute in important degree to the marked improvement stated to have been made in the operation of the blast furnaces; it simply makes public the fact that there are men who take it for granted that it has been found at the Anyox plant that the Hidden Creek ore smelts better when fed large than when crushed to a smaller size.

Sometimes a newspaper man with a lively imagination "gets in his work." There is published in one of the British Columbia coast cities a newspaper of mature years and so circumspect in its determination to protect the dear guileless public that it every now and again declines to publish "mining news." Some time ago, when half-page and page advertisements of the "get rich quick" order were obtainable, it was not averse to admitting some of them to its advertising columns, but that, of course, is "a horse of another color," for newspapers must live. But to come to the present story—an "esteemed contemporary" printed what on the face of it appeared to be a press despatch from Seattle. Next day the circumspect one improved (?) on that despatch, in these words: "Heralding the resumption of a steady carrying trade between the copper plants of British Columbia and the markets of North America, the steamer Amur, with 550 tons of refined copper, worth approximately $165,000, aboard, has completed her first trip in many weeks between Granby Bay, B.C., and Seattle. Since the beginning of the war, the great mining and smelting plant of the Granby Consolidated Mining, Power & Smelting Co., at Anyox, has been practically closed down, as when hostilities broke out the bottom fell out of the copper market. This state of affairs resulted in the temporary suspension of shipments South from Northern smelters. The resumption of trade is attributed to the general renewal of confidence in business throughout the North American continent. The big British Columbia smelting plants, situated on the Portland canal, will soon be in full blast again, and the steamer Amur will ply regularly between Granby Bay and Seattle, carrying valuable refined cargoes of metal, and returning North towing barges loaded with coke."

The Canadian Mining Journal published in its issue of November 1 (pp. 709-712) the Granby Co.'s annual report, including a statement made by the president as on October 6. There was little in that report suggesting that the company's works at Anyox had "been practically closed down," as stated in print in Seattle and Victoria toward the middle of December. In fact, the production in October of 1,794,000 lb. of copper shows that, on the contrary, there must have been much activity, during that month at any rate. Then there is the buncombe about refined (?) copper from smelting plants on Portland canal (?)—but there; irresponsible space fillers cannot be bothered with facts, they only want "news." It is too bad, though, that the circumspect newspaper quoted has to be so particular about its "mining news."

CERRO DE PASCO MINING CO.

Very little creeps into print concerning the Cerro de Pasco Mining Co. It is a close corporation and for this reason shuns publicity. About 40 per cent. of the company's stock is understood to be owned by the estate of the late J. B. Haggin.

There has been an investment to date of fully $25,000,000 in the enterprise which was started in 1902. The mines are located in Peru, over 14,000 feet above sea level.

History records that silver was discovered at Cerro de Pasco in 1630 and the mines produced to the close of the nineteenth century about 450,000,000 ounces from 40,000,000 tons of silver and copper ore, nearly all extracted by hand work and carried three to six miles on the backs of llamas to primitive smelters, whence the silver bullion was transported by llamas 200 miles to Lima, until 1870. Formerly only the ores of 25 per cent. to 40 per cent. copper were shipped.

The introduction of modern machinery and methods, albeit under many discouraging handicaps, has resulted in the building up of an enterprise capable of producing over 70,000,000 pounds of copper per annum.

An official of the company gives the Boston News Bureau the following figures of output for the past three years, November and December, 1914, being estimated:

1912—45,272,000 pounds fine copper, net refinery returns.

1913—43,856,000 pounds fine copper, net refinery returns.

1914—42,000,000 pounds fine copper, net refinery returns.

The official adds: "The company's smelter has a capacity when running full of at least 6,000,000 pounds per month. Had it not been for the war we had hoped to reach this capacity the last half of this year. At the present time we are shipping at the rate of 2,500,000 pounds per month, or about 40 per cent. capacity."

ALBERTA OIL.

What is claimed to be the most important development in the history of the South Alberta oil fields since the discovery of the light volatile oil in the Dingman well occurred on an isolated hill top under the shadow of the Rocky Mountains last week when nearly a barrel of heavy crude oil, olive green in color, and sparkling with life, was baled from the well of the Moose Mountain Oil Company, Limited, eighteen miles southwest of the town of Cochrane. The following facts about the strike are given in the Calgary Herald: Crude oil struck Friday, November 20, 1914. Depth of well when first real showing was made 1627 feet. Well was spudded in September 28, 1914. Oil contains about 35 per cent. gasoline and is expected to test 45 to 47 baume. Drill has gone through 30 feet of black sands and still in them. The section on which the well is being drilled was located by George W. Harris, a director of the company. The actual well site was selected for the company by E. H. Cunningham Craig.

MARKETS

STANDARD EXCHANGE, TORONTO.

Dec. 28, 1914.

	Sellers.	Buyers.
Cobalt—		
Bailey	.01⅝	.01⅜
Beaver	.23	.21
Buffalo	1.05	.85
Chambers Ferland	.15	.14
Coniagas	5.80	5.25
Crown Reserve	.70	.63
Foster	.05	...
Gifford	.03	.01
Gould	...	.00½
Great Northern	.05¼	.04¾
Hargraves	.02	.01½
Hudson Bay	50.00	35.00
Kerr Lake	4.55	4.30
La Rose	.80	.75
McKinley-Dar.-Sav.	.60	.53
Nipissing	6.05	5.75
Peterson Lake	.29½	.29
Right of Way	.03	.02
Seneca-Superior	2.00	...
Silver Leaf	.03	.02½
Silver Queen	.03	.01½
Timiskaming	.10	.09
Wettlaufer	.10	.04
York, Ont.	...	.06¼
Porcupine—		
Apex	.02	.01½
Dome Extension	.08½	.08
Dome Lake	.37	.35
Dome Mines	7.50	6.75
Foley O'Brien	.20	.16½
Gold Reef	...	.03
Homestake	...	.15½
Hollinger	20.50	19.95
Jupiter	.10¼	.10
McIntyre	.24¼	.23
Pearl Lake	.03½	.03⅜
Porcupine Crown	...	.67
Porcupine Crown	.01	.00½
Porcupine Imperial	.01¾	.01¼
Porcupine Pet	...	.15½
Porcupine Tisdale	...	.00¼
Porcupine Vipond	.23½	.22½
Preston East D	.01½	.01
Rea Mines	...	.19½
Teck-Hughes	...	.08

MONTREAL MINING EXCHANGE.

Dec. 23, 1914.

	Bid.	Asked.
Beaver	.20½	.23
Chambers Ferland	.13	.14½
Crown Reserve	.70	.74
Dome Lake	.34½	.37
Dome Mines	6.25	7.25
Dome Extension	.08	.09
Hollinger	19.75	20.25
Jupiter Mines, Ltd.	.09	.09½
Kerr Lake	4.50	5.00
La Rose	.73	.78
McKinley Darragh	.50	.60
Motherlode Sheep Creek	.10	.15
Nipissing	5.50	6.00
Peterson Lake	.28	.29
Porcupine Crown	.70	.78
Rea Consolidated	.15	.25
Silver Leaf	.01½	.02½
Timiskaming	.09	.10½
Porcupine Vipond	.22	.24
McIntyre	.22	.24

TORONTO MARKETS.

Dec. 28—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 6 cents per lb.
- Lead, 5 cents per lb.
- Tin, 35 cents per lb.
- Antimony, 17 cents per lb.
- Copper, casting, 13½ cents per lb.
- Electrolytic, 13½ cents per lb.
- Ingot brass, yellow, 10c. per lb.; red, 12 c. per lb.

Dec. 28—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $8.00 per ton.
- Coal, bituminous, $5.25 per ton.

GENERAL MARKETS.

Dec. 24—Connellsville coke (f.o.b. ovens)—
- Furnace coke, $1.60 per ton.
- Foundry coke, prompt, $2.10 to $2.50 per ton.

Dec. 24—Tin, straits, 33.75 cents.
- Copper, Prime Lake, 13.10 to 13.20 cents.
- Electrolytic copper, 12.85 to 12.95 cents.
- Copper wire, 14.50 cents.
- Lead, 3.80 cents.
- Spelter, 5.60 to 5.70 cents.
- Sheet zinc (f.o.b. smelter), 8.75 cents.
- Antimony, Cookson's, 15.00 to 15.50 cents.
- Aluminum, 18.75 to 19.25 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, soft, $44.00 to $45.00 per ounce.
- Platinum, hard, 10 per cent., $47.00 to $49.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $50.00 per 75-lb. flask.

SILVER PRICES.

December—	New York cents.	London pence.
12	49⅞	23 1/16
14	49⅞	23 1/16
15	49¾	23
16	49⅝	22 15/16
17	49½	22⅞
18	48⅞	22⅝
19	48½	22½
21	49⅜	23
22	48⅛	22⅜
23	48⅜	22½
24	48¾	22 11/16

SILVER BULLION SHIPPED.

Cobalt, Dec. 26.

Bullion shipments for the week will be higher than usual, and it is altogether probable that the shipments for the month of December will establish a record for the year. This week four mines have shipped silver bars as follows:

Mine.	Bars.	Ounces.	Value.
Nipissing	208	241,192	$117,882
*Crown Reserve	68	69,000	34,500
Crown Reserve	14	15,000	7,500
Dominion Reduction	41	46,371	23,050
Drummond	4	4,956	2,478
Total	335	376,519	185,440

*Shipped from Deloro.

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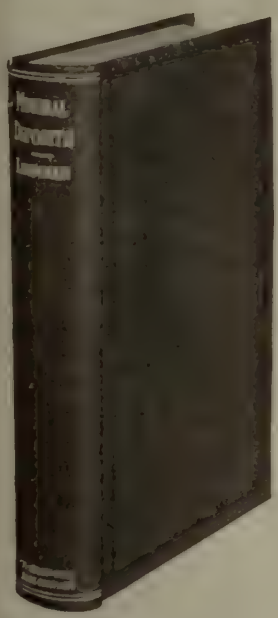

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Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.

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Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
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Peacock Bros.

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Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
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Peacock Bros.
Mussens, Ltd.
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Jones & Glassco.
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

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Can. Ingersoll-Rand Co., Ltd
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Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

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Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
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Jeffrey Mfg. Co.

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Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
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Fraser & Chalmers of Canada, Limited
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Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
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Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited
The John Inglis Co., Ltd.

Pumps—Electric—
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Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited
The John Inglis Co., Ltd.

Pumps—Pneumatic—
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Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd
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Dominion Bridge Co.
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Northern Canada Supply Co.
Can. H. W. Johns-Manville

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Mussens, Ltd.

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Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
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Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

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Runways, Hand Operated—
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Ledoux & Co.
Milton Hersey Co.
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Fraser & Chalmers of Canada, Limited
Jenckes Machine Co., Ltd.

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Mussens, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

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Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

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W. F. Stanley.
C. L. Berger.

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Northern Electric Co., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
Jenckes Machine Co.
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.

Transformers—
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.

Transits—
C. L. Berger & Sons.
Peacock Bros.

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Tube Mills—
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Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Winding Engines—
Mussens, Ltd.
Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.

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Northern Canada Supply Co.
B. Greening Wire Co.

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Zinc Dust—
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CANADIAN MINING JOURNAL

VOL. XXXVII TORONTO No. 2

In This Issue:

Mining in Ontario in 1915

Coal Mining in British Columbia in 1915

Smelting of Cobalt Silver Ores

Alloy Steels

The Canadian Mining Journal, Purman Bldg., 263-5 Adelaide St West, Toronto, Ont.

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CONTENTS

MINING IN CANADA IN 1915

Canada is making new records in mineral production and the outlook for 1916 is very promising. This is a pleasing contrast with the conditions a year ago, when the disorganization of industry which followed the outbreak of war resulted in a severe though brief check to the ever-increasing mineral output of the Dominion.

In Canada, as in other countries the production in the early months of the war was small. Production of most metals might have been increased, but, owing to the general disorganization of business with consequent temporary falling off in demand for mine products, many mines were closed and many others operated at half capacity. The demand for war munitions during 1915 and the increase in general business in the latter part of 1915 created an unprecedented market for most metals.

The year 1915, in spite of the low output in the early months, shows an increase in production of metals in Canada. Non-metals are, as a rule, not in as great demand as before the war.

Ontario for 1915 shows a greatly increased output of gold, nickel and copper, and a substantial decrease in silver. The estimated value of the production for 1915 is: Gold, $8,000,000; silver, $10,750,000; nickel, $7,200,000, and copper, $2,700,000. The output of nickel-copper matte is being very greatly increased and it is expected that the December output will be over 7,000 tons matte. The iron ore production will be slightly greater than in 1914, but the Moose Mountain mine has been closed down. Petroleum output is less than in 1914, but natural gas production is larger. Structural materials are not in as good demand as in 1914. Pyrite shipments have increased. The operation of a graphite property in Eastern Ontario has been successfully begun during the year.

Alberta coal production in 1915 will show a decrease of about 500,000 tons, being estimated at 3,250,000 tons as compared with 3,743,672 tons for 1914. In the last quarter of 1915 conditions are much improved and output is being increased.

Quebec in 1915 shows an increase in production of metals and decrease in non-metals. The latter make up a very large part of Quebec's output and consequently the total production shows a considerable falling off as compared with 1914. After a period of dullness the asbestos market has improved greatly and the latter part of 1915 has seen a return to normal conditions in the asbestos district.

The great demand for chromite resulted in operations being resumed at several chromite properties in the Coleraine-Black Lake region. Copper and pyrite

production has been increased. A new mill is being erected to replace the Eustis mill which was burned in August. Lead-zinc deposits at Notre Dame des Anges are being successfully worked. Four companies are operating magnesite properties.

The production of British Columbia in 1915 will be about $30,375,000. This is an increase over 1914 though less than that of 1913, the record year. A great increase in production of copper has helped to swell the total. The value of the chief products is estimated as follows: Placer gold, $680,000; lode gold, $5,481,000; silver, $1,812,000; lead, $1,756,500; copper, $9,978,500; zinc, $1,395,000; coal, $5,782,000; coke, $1,490,500; miscellaneous, $2,000,000.

Nova Scotia's chief mineral product is coal. The production for 1915 is estimated at 6,600,000 tons, or practically the same as that of 1914. The output in the last quarter of 1915 was considerably larger than for the corresponding period of 1914. The coaling of ocean ships has become quite a feature of the Nova Scotia coal trade.

In the Yukon gold production during 1915 was about $4,750,000, a slight increase over that of 1914. The first machine for use on the Treadgold properties arrived during the year and will probably be in operation during 1916.

EDUCATION IN MINING

In a letter published in the January bulletin of the Canadian Mining Institute Mr. John A. Dresser makes some very interesting comments on education in mining. He says: "The highway to efficiency is education. The means of education vary widely in kind and degree, and man's time and ability to learn are inevitably limited. Consequently our methods of education in mining and metallurgy as well as in every other profession call for careful thought and closest scrutiny."

We should not be satisfied with our present methods of education. It is in the best interests of the mining industry to improve methods of preparing the young men who elect to make mining their profession. Every contribution to the discussion will help those who are responsible for the teaching of mining students.

It should be borne in mind that mining in Canada is increasing at a rate which is much greater than is generally appreciated. The public learns, for instance, that the Cobalt silver mining companies have passed their zenith as profit makers and jumps to the conclusion that mining is on the wane. As a matter of fact not only is production in other districts being increased, but in such districts as Cobalt there are many mining and metallurgical problems which will for years continue to make demands on the best technical talent available. The fact that lower grade ore must be treated in succeeding years means that profits will be smaller and that the necessity for efficiency will be more acute.

Mr. Dresser inclines to the belief that the number of students in mining will fluctuate with the demand for graduates. No doubt it will, but it fluctuates in a way that those who are connected with mining colleges find it difficult to understand. At present there is a demand for mining graduates that Canadian colleges will scarcely be able to meet. Young men should be encouraged to enter the profession. But those who are engaged in mining owe it to these young men to use their efforts to make the years of preparation as profitable as possible.

At the meeting of the Canadian Mining Institute in March there will be, according to the January bulletin, consideration of the subject of mining education. It is to be hoped that those in charge of mining operations as well as those engaged in teaching will voice their opinions.

The price of silver is holding well around 56 cents and the prospects for larger profits in 1916 than in 1915 are very good. During a year of low prices the Cobalt district suffered considerably. However, most of the mines continued to yield large profits. The margin of profit was considerably lower during 1915 than in any previous year, and it was found advisable in some cases to restrict production, not because it was not profitable, but because larger profits from higher prices were expected to be available later. In some cases production was necessarily restricted owing to decrease in ore reserves. It is not to be expected that all the mines will make large production in the future, for a large part of the high grade ore has been worked out. There is still a lot of silver in the Cobalt district, however, and with higher prices available it may be expected that renewed activity will result. Already several old properties are being reopened.

There is a great deal of interest being shown in oil flotation methods in mining districts throughout Canada and the United States. Many Canadian metallurgists are experimenting. It will not be surprising if methods are devised for profitably treating the sand and slime piles at Cobalt which contain four to eight ounces of silver per ton and which might conceivably be treated at a cost of 50 cents per ton. That is perhaps too much to hope for; but it is a figure that has been suggested by one who has done a great deal of experimenting on Cobalt ores.

The Mond Nickel Company has carried out a number of experiments on flotation of nickel-copper ores and it is not improbable that the Sudbury district ores will be further tested. The results obtained so far are, however, not available for publication.

Hollinger made a new record in the four weeks ending Dec. 2, making a gross profit of $210,588.52 on 29,448 tons ore treated. During 1915 the company distributed $1,560,000 in dividends and spent about $300,000 on additions to plant; but is nevertheless able to report an increase in surplus.

ELECTROLYTIC REFINING OF ZINC

Notable progress in the metallurgy of zinc was made in 1915, and a number of plants designed for the treatment of zinc ores by leaching and electrolysis have been installed. Canadian companies are taking a prominent part in the development of the processes and three of the plants now in operation are in Canada. The Weedon Mining Company, which is operating a lead-zinc mine at Notre Dame des Anges, Quebec, has put into operation at Welland, Ont., a plant in which the Watts process is used. At Trail, B.C., the Consolidated Mining and Smelting Company of Canada has carried on much experimental work on electrolytic refining of zinc, and has produced spelter from Sullivan mine ore at the rate of 1,000 pounds per day. The results obtained were considered promising enough to warrant the construction of a larger plant. There is now being erected at Trail a plant designed for an output of twenty-five to thirty-five tons per day. At Silverton, B.C., the Standard Silver Lead Mining Company is using the French process of electrolytic production of zinc.

In view of these developments an article published in the January 1st issue of Metallurgical and Chemical Engineering if of special interest. The authors, D. A. Lyon, O. C. Ralston and J. F. Cullen, of the Department of Metallurgical Research, University of Utah, say:

"When the European war started there were three electrolytic zinc plants in Europe supposed to be operating on a commercial scale. All of these were on a small scale, and were producing zinc from by-products. At Winnington, Northwich, Cheshire, England, was the plant of Brunner, Mond & Co., which is an alkali works and which has been disposing of calcium chloride solution wastes by leaching zinc ores with them (with simultaneous action of carbon dioxide). This gave a zinc chloride solution from which the zinc was recovered by electrolysis, giving a spelter containing 99.96 per cent Zn., and producing chlorine gas which was absorbed to make bleaching powder. This process is one of those originally designed by Hoepfner, and was experimented on during the 90's in Germany, resulting in the installation of a like plant at Duisburg, Germany. Both of these plants have kept secret the exact details of the process by which they have been able to get good zinc deposits as their pure spelter has been for years at a premium of at least 1 cent above the ordinary market price. In 1914, a plant was built for treatment of zinc carbonate ores at Kristiania, Norway, under the direction of Borchgrevink, and another at Balestrand, Sogn, Norway, under the direction of E. A. Ashcroft, to treat flotation concentrates from Broken Hill. So far as we know, nothing has been heard of these plants since the war began.

"In the United States and Canada, however, a great deal of experimental work has been done on the leaching of zinc from ores with its subsequent electrolysis. Nearly all of this work has been sulphuric acid leaching followed by the electrolysis of the zinc sulphate solution. While all the various plants have this much in common, the details of the work vary at most of them by almost as many methods as there are plants.

"The Anaconda Copper Co. perhaps has gotten farther along with this work than have most of the other companies. They now have a 25-ton plant nearing completion. By a 25-ton plant is meant one that will produce 25 tons of metallic zinc per day. The Anaconda metallurgists regard this as only an experimental plant. Some splendid work has been done at Anaconda in their research work in connection with the development of the process which they are using and the publication of the details of this work by Mr. Laist and his associates will be keenly awaited by those interested in this line of work.

"As to the general outline of the processes employed at the various plants at Trail, B.C., and at Anaconda, the electrolytic liquor containing sulphuric acid, regenerated by electrolysis with insoluble anodes, is used for leaching the ore. The ore is a roasted complex sulphide of lead and zinc carrying silver, some gold (and some copper in the case of Anaconda). By the use of barely sufficient acid to dissolve the zinc, it is possible to get a solution of zinc sulphate carrying low amounts of the other constituents of the ore. This solution must be cleaned by the use of zinc oxide, lime or other cleaning agents, and is then electrolyzed. At most of the plants, lead anodes are used in the electrolytic tanks in order to regenerate sulphuric acid. The process as thus outlined is old, but the refinement of detail has been the feature of nearly every plant attempting to use it.

"At Murray, Utah, and Omaha, Neb., are small plants recovering zinc electrolytically. The one at Murray is following the practice as developed at Anaconda, with variations made necessary by local conditions. It is only an experimental plant and it is expected to produce about 2 tons of zinc per day. The Omaha plant is working on zinc oxide material from the refining of argentiferous lead by the Divine process, and is also in the nature of an experiment.

"Perhaps the most extensive research work on the leaching and electrical precipitation of zinc has been carried out on the ores of the Bully Hill mine, Shasta county, California. The process for the Bully Hill ore was worked out on the assumption that a good deposit of zinc cannot be obtained from a solution containing much sulphuric acid and the effort has been to neutralize the acid as fast as it is formed at the lead anodes. In treating the Bully Hill ore, lime is used to precipitate zinc hydroxide and calcium sulphate from the solution of the zinc sulphate. This precipitate is suspended in the zinc sulphate liquor of the electrolytic cell and as fast as sulphuric acid forms it is neutralized by the zinc hydrate.

"The Reed Zinc Co., whose plant is at Palo Alto, Cal., has operated on the bag house dust from the Kennett smelter of the U. S. Smelting, Refining and Mining Co. This is also an experimental plant designed to produce about a ton of zinc per day. Instead of a solid lead anode they use a sponge lead anode resembling the electrode used in a storage cell. As fast as sulphuric acid is formed at this anode it combines with the lead, forming lead sulphate. This lead sulphate can later be used to give up the acid by reversing the current, after placing the electrode in a sulphuric acid solution. The solution for electrolysis is prepared by dissolving zinc sulphate crystallized from the leaching liquor.

"At Silverton, B.C., the Standard Silver Lead Mining Co. is also experimenting with the production of electrolytic zinc by the French process. French was probably the first man to use manganese in the electrolysis of zinc sulphate solutions, although its beneficial effect has been noticed by other investigators. He found that it deposits as dioxide on the anode and can

be redissolved in sulphuric acid and used over again. He operates his process with considerable of the manganese sulphate in his electrolyte, and instead of using sulphuric acid for leaching, uses a solution of by-product sodium bisulphate.

"At Welland, Ontario, the Weedon Mining Co. is also said to be meeting with success in operating the Watts process. This process proposes the use of a solution of zinc sulphate for an electrolyte in electrolysis, the depolarization of the anode and the prevention of the formation of sulphuric acid by the use of any solid compound of zinc which does not contain objectionable impurities, such as zinc oxide, or blue powder. The fundamental idea of this process is the same as has been worked out in the treatment of the Bully Hill ore. It is also brought out in the recent patents of O. Best, of Oakland, Cal.

"At Mt. Read on the west coast of Tasmania, it has been reported that the Tasmanian Metals Extraction Co. erected a plant for the treatment of zinc-bearing ores, producing a concentrate of zinc oxide. Nothing of the details of the process has been given out, but the zinc is doubtless precipitated from solution by a solution of some alkali, and the resulting hydrate calcined to oxide."

The rapid advancement now being made in the hydrometallurgy of zinc is in no small measure due to the war. There is at present an unusual demand for a high grade product and the price of all grades of spelter is high. There has seldom been a better opportunity to try out the electrolytic method. While it is not unlikely that experimental work would have been carried on by some of the companies under normal conditions, there would hardly have been the same progress in such a short time, but for the incentive given by war demands.

It seems likely that the electrolytic process will prove so successful that it will be well established and many difficulties overcome before the price of zinc returns to its pre-war level. It seems reasonable to expect the cost of treatment to be so much lowered that the problem of treating our troublesome zinc ores will have been very considerably minimized. It is a long time since any such advance has been made in the metallurgy of zinc. The owners of zinc deposits in Canada will do well to consider how the activities of metallurgists have increased the value of properties during 1915.

Calumet and Hecla Mining Company on New Year's Day announced a ten per cent. increase in wages to all employees. The big company is making a large output of copper and disposing of it at a good price. As usual under such circumstances the employees are given a share of the profit. The Calumet & Hecla management has a reputation for efficiency and consideration of employees that is second to none. The New Year's present is characteristic of the company.

According to our Cobalt correspondent the Nipissing stopes are now more nearly full of ore than at any time in the history of the company and discoveries of new orebodies at the Meyer shaft and under Cobalt Lake makes the future brighter than for a long time.

At the Dome numerous additions are being made to plant and the mill output is increasing. The December production was 30,120 tons, averaging $5.34 per ton.

Owing to the war the cost of explosives for mining purposes has been considerably increased. This is of course to be expected. The extraordinary demand has resulted in great advances in the price of raw materials.

There is considerable interest in prospects at Porcupine and it is not unlikely that several claims, now idle, will be developed this year.

The National Graphite Company of Toronto has successfully put into operation its mine and mill in Hastings County. A very good product, comparing favorably with any on the market, is being obtained.

The Sudbury mining district is experiencing the most prosperous period in its history. The insistent demand for nickel and copper has led the producing companies to push production to capacity. This, however, has proven insufficient and important additions to plant are being made and planned. It is evident that the present year will witness an enormous increase in production of nickel and copper matte. Already the output has been increased to an extent not thought possible a few months ago.

Of the leading gold mines at Porcupine, Hollinger produced $3,000,000, Dome $1,325,000, Acme $900,000, McIntyre $750,000, Porcupine Crown $600,000, Vipond $265,000, and Dome Lake $105,000 in the year 1915. As a gold producing district Porcupine is making an excellent record. The 1916 output is expected to be considerably larger.

The revival of chrome mining in Quebec, concerning which Mr. A. C. Allenson contributed an article in our issue of Sept. 15, has resulted in over 10,000 tons being shipped in the latter half of the year 1915. Twenty-two mines and prospects contributed to this total.

The demand for copper and pyrite has favorably affected the mining industry in Quebec. The Weedon and Eustis mines are making a large production of pyrite.

Good results are being obtained by the Weedon Mining Company in treating complex lead-zinc ores, at Notre Dame des Anges, by oil flotation methods. A commercial concentrate is being made. The concentrate will be roasted at the mine and then shipped to Welland for treatment by the Watts electrolytic process.

In Michigan the wages of copper miners have been gradually raised as the price of copper warranted it, until they are now the highest ever known in the district.

MINING IN ONTARIO IN 1915

Ontario made a good record in 1915, showing very large increase in production of gold, nickel and copper and some increase in lesser metallic products. Against these increases were considerable decrease in silver output and a falling off in demand for structural materials.

Porcupine shows an increase of over $2,500,000 in gold production. The Hollinger mill was treating 7,034 tons per week in November as against 5,706 tons in January, and making a gross profit of $46,192 per week as compared with $37,746. The average value of the ore varies but little from month to month. It began in January at $11.10 per ton and in November was $10.34. The total output for the year was about $3,000,000. The Hollinger, which is paying 4 per cent. dividend every four weeks, or 52 per cent. per annum on its capitalization of $3,000,000, has a claim to be ranked among the great gold mines of the world. Its veins are numerous and persistent in depth, and some of them are large. A number of new and valuable veins have recently been found in underground exploration. A six-compartment central shaft is being steadily pushed down, and it is intended to operate the adjoining Acme claims, controlled by the same interests, in conjunction with the Hollinger. The Acme ore is treated in the Hollinger mill, but the returns are kept separate. The yield from the Acme for the twelve months was over $900,000.

During 1915 $300,000 was spent on increasing plant at the Hollinger and $1,560,000 was paid in dividends; but, nevertheless, the balance sheet at the end of the year showed an increase in surplus.

Further increase in milling capacity is under consideration. The metallurgy at the Hollinger mill has not been changed; it is still making use of the modified system of counter-current decantation, together with filtration of part of the residue. Stamp crushing has always been considered satisfactory at the Hollinger, and no change has been made in it.

The Dome mine also shows an improved position as compared with the beginning of the year. Exploration at the fourth and fifth levels has revealed the existence of much better ore than the mixed material on which the mill operated in 1914, and in consequence the average contents have risen in value from $4.25 per ton to $5.50. At this rate the production of the Dome in 1916 should be nearly equal to that of the Hollinger. In 1915 the gross return was about $1,325,000. Opened on a mass of quartz that showed remarkable value in spots, the Dome speedily took on the character of a low-grade mine. The richer ore, resembling that of the original Dome, has materially improved the Dome's prospects. The mill is being enlarged and is expected to be in shape next March to treat about 55,000 tons of ore per month.

No change in the metallurgy is under consideration, the system continuing to be stamp crushing, regrinding in tube mills and separate treatment of sand and slime.

McIntyre-Porcupine Mines, Ltd., produced about $750,000 in 1915. This company has greatly enlarged its sphere of operations by securing control of adjoining property, formerly held by the Jupiter and Pearl Lake companies. This section of Porcupine will now be developed more energetically and the production will be much larger when the plans for working the three properties jointly have been carried out.

Porcupine-Crown's operations during 1915 yielded about $600,000. The Porcupine-Vipond took out about $265,000, and Dome Lake about $105,000. The Schumacher mill began to obtain bullion in November. The outlook at Porcupine for the incoming year is undoubtedly good.

Of the other gold mining areas, Kirkland Lake is perhaps the most advanced. Here the new mill at the Tough-Oakes mines began to run shortly after the beginning of the year and has done excellent work. The veins of this mine though narrow are rich, and the ore treated averaged about $19.00 per ton, some $450,000 having been obtained altogether.

The Tough-Oakes mill, completed in 1915, is a highly developed cyanide plant for handling rich gold ore. It is referred to by Mr. Herbert A. Megraw in the following terms: "This is probably the most important plant finished and operated during the year. It certainly embodies the results of the most advanced technical study. The Tough-Oakes is a 100-ton all-slime cyanide plant, in which a ball mill replaces stamps. In this case a ball mill of the Hardinge type is installed, the product of which goes to two Dorr classifiers, each operating in closed circuit with a 5 x 20 ft. tube mill. Provision is made for the introduction of copper amalgamating plates should that at any time be considered necessary. The slimes from the Dorr classifiers go to a thickener, the overflow of which is clarified and precipitated. The pulp is sent to Dorr agitators and a series of continuous counter-current thickeners. Transfers of thickened pulp are effected by diaphragm pumps. From the final tank the thickened pulp is discharged by a spigot into a launder, whence it runs through a mechanical-sampling device and then to waste. It will be noticed that in this plant the newest developments of cyanide metallurgy are incorporated. The elimination of stamps from the metallurgical lay-out is a feature that is becoming increasingly frequent during the last few years, and one that will probably become the rule in the future. Continuous pulp-flow and automatic transfer of pulp in solution is another feature of the mill. The elimination of the slime filter for the tailings is a feature of importance. The mill design was under charge of the Butters-Johnston Engineering Syndicate."

Of other properties at Kirkland Lake, the Teck-Hughes has been acquired by Buffalo Mines, Limited, and the latter is building a large mill for treating the ore. Beaver Consolidated is another Cobalt company which has interested itself at Kirkland Lake, having late in the year taken an option on the stock of the Kirkland Lake Gold Mines, one of which company's claims, known as the McKane, adjoins the Teck-Hughes, and is said to carry high values. The Lake Shore is another company engaged in developing promising showings in the same neighborhood.

Several other districts have contributed to Ontario's gold production in 1915. The Canadian Exploration Co., at Long lake, near Sudbury, won about $260,000. In Munro township, quartz of phenomenal value was found in the Dobie-Leyson claim, now known as the Croesus mine. From 800 pounds of rock $40,000 in gold was recovered by hand, and in a shaft 125 feet deep, with a little drifting and crosscutting, it is re-

ported that a million dollars' worth of gold has been put into sight.

The year was more than ordinarily prolific in promising discoveries. In Boston township, J. K. Papassimakes is developing a claim which shows in places a free distribution of fine gold in dark greenish quartz, and in Pacaud, the next township to the south, Miller and Connell have acquired the McDonough claim, one of the best looking finds of the year. This is a quartz vein a foot wide and about 2,000 feet long, showing free gold wherever uncovered. At Kowkash, 300 miles west of Cochrane, on the National Transcontinental Railway, a spectacular find of gold in quartz was made in August by E. King Dodds, but on sinking, the values disappeared. South of Dryden, on the Canadian Pacific, near Lake Wabigoon, a narrow and irregular vein showing abundance of free gold was located by E. G. Rognon. These veins no doubt will all be opened up in the near future. Meantime the year closed with a decidedly optimistic feeling so far as gold mining is concerned.

Silver production in Ontario in 1915 was smaller than in 1914. The decrease amounted to approximately $2,000,000, the product having a value of about $10,750,000 as against $12,795,214 in 1914. In other words for every six dollars won in 1914, the mines last year won five. Part of the decrease is due to the low prices which prevailed for silver from January until November, when a sudden and decided increase took place, amounting to 8 or 9 cents per ounce. This had the effect of stimulating production and development, and the year ends at Cobalt with a much improved outlook as compared with a year ago. The leading mine at Cobalt is still the Nipissing, the Mining Corporation of Canada coming next, and Coniagas, Kerr Lake, Seneca-Superior, Temiskaming, Beaver, McKinley-Darragh-Savage, O'Brien and LaRose following. The finding of new veins continues to reward exploration, both above and below ground. At the Townsite mine a system of high grade veins has yielded much rich ore. Deep drilling is in progress at the Beaver mine in the hope of eventually encountering good ore at the lower contact of the diabase sill and the Keewatin. Most of the silver produced from the mines is now refined in the Province; much of it at the mines themselves and the remainder by the refineries at Deloro and Thorold. The sale of cobalt and nickel oxides has almost ceased since the war began, but the refineries are beginning to produce both metallic cobalt and metallic nickel.

Taken together, the value of the gold and silver obtained in Ontario in 1915 exceeded that obtained in 1914, but while the production of gold is going up, that of silver is going down. The famous mines of Cobalt have passed their zenith, and their yield is decreasing. Production was stimulated by the sudden and decided rise in the price of silver in November. By-products of the Cobalt ores, particularly cobalt oxide and nickel oxide, had a poor year, the continental markets in Europe being cut off by the war. In consequence, stocks of these substances are accumulating at the refineries.

At Cobalt during 1915 a new slimes plant was built by the Cobalt Reduction Co. This plant was designed to handle the slime from the concentrating mills. It is being successfully operated.

The output of nickel in Ontario in 1915 was the greatest in the history of the Province, and further, the rate of production to-day is much higher than in the early part of 1915. The year's output was about 32,000 tons of nickel. Practically all of this came from the Sudbury district, the Alexo mine near Porcupine and the Cobalt ores contributing a small proportion. The Canadian Copper Co. and the Mond Nickel Co. have been pushing production to the utmost limit of their capacity in the effort to supply the demand for war purposes. Most of the former company's output was from the great Creighton mine, the ore of which carries a high percentage of nickel as compared with the average of the mines in the district. The Mond company draw their ore from a number of openings, including the Garson and Levack, the latter having reached the stage of steady production. The Alexo ore is purchased by the Mond company and smelted at Coniston, and this company has also bought the old Bruce mines for the sake of its siliceous ores which are desirable for smelting mixtures, and which besides carry an appreciable percentage of copper. The final product of the Sudbury plants is the Bessemer matte, containing 75 or 80 per cent. of nickel and copper combined. This is sent to New Jersey by the Copper company and to Wales by the Mond company for final separation of the metals. Values in gold, silver, platinum and palladium are also recovered from these mattes.

The copper production of Ontario increases with the nickel production, the copper occurring with the nickel in the ores of the Sudbury district. The output in 1915 was about 18,750 tons. In addition to the nickel-copper ores there was mined during the year some siliceous copper ore from the old Bruce mines. This is used as a flux at the Coniston smelter. The Mond company purchased the Bruce mines recently.

Although Moose Mountain mine is now closed down, shipments of iron ore during 1915 were somewhat larger than in 1914. Production during the first nine months of 1915 from Helen, Magpie and Moose Mountain mines was valued at $601,444.

On the other hand, the quantity of pig iron turned out by the blast furnaces of the province fell off materially. Most of the iron ore charged in these furnaces is imported from the United States.

The demand for building materials and clay goods, owing to the stoppage of building operations consequent upon the war, was not good in 1915, and production of these non-metallic substances consequently fell off. Petroleum continues to be pumped in the Lambton field, but in diminishing quantities, the yield in 1915 being not over 7,000,000 gallons. Natural gas, on the other hand, has been obtained in much larger volume during recent years than formerly, and valued at a low figure at the wells, the production in 1915 was worth about $2,300,000.

Pyrite production was considerably increased during 1915 and the National Graphite Co. put into successful operation its mine and plant in Hastings county. Salt production was about as usual. There was a small production of molybdenite and a concentrating plant has been put in operation by the Orillia Molybdenum Co.

While the record of Ontario's mines in 1915 is a very good one, considering the ill effects of the war, the year's record is hardly indicative of present activity. Production during the latter part of the year was much greater than in the early months and was never so great as it is to-day.

The year 1916 will be a busy one at the mines. Increase in production is being planned and numerous additions to plants will be necessary. Several new properties and some old ones are being opened up.

COAL MINING IN BRITISH COLUMBIA IN 1915

By E. Jacobs.

The gross production of coal in British Columbia in 1915, that is including the coal made into coke, was approximately 2,308,000 short tons. It being the official custom of the province, however, to record production in tons of 2,240 lb., it will be more convenient to make comparisons in that measure. The quantity given above is subject to revision when the final returns shall come in, an estimate having been made of the December production in arriving at the total here used as representing the production of 1915. The following table affords opportunity for making comparisons between the totals of output of six successive years:

Gross output in	Tons of 2,240 lb.
1915	2,060,804
1914	2,166,428
1913	2,570,760
1912	3,025,709
1911	2,297,718
1910	3,139,235

The year 1910 was the "record year" of the coal production of British Columbia; since then conditions have been in one way or another unfavorable to a correspondingly large yearly output—large for the province—being made. For eight months of 1911 the Crowsnest District collieries were closed, owing to non-agreement between the operators and the mine-workers relative to wages, etc.; the result, so far as production was concerned, was a decrease of 941,000 tons as compared with the 1910 output of that district. For several months of 1912 there was labor trouble at the mines of the Canadian Collieries (Dunsmuir) Limited, with a resultant decrease in output of coal. In the spring of 1913 the United Mine Workers of America determined to force an issue and so called a strike at all the coal mines on Vancouver Island, so there was a decrease of 616,000 tons in that year's production in the Coast district as compared with that of 1911 when there was not any similar obstacle in the way of production. The reasons for a further decrease in the total output in 1914, as stated in the official "Annual Report of the Minister of Mines" included the following: "The decreased coal output is undoubtedly entirely attributable to the war, not acting directly, but through the allied industries which serve as customers for the colliery products, an illustration of the interlocking of the modern commercial business. In the interior of the province the effect of the war was first felt in the complete demoralization of the metal markets, which are essentially world markets. This led to the immediate shutting down of all the larger copper mines and smelteries, thus removing an important factor in the market for coal and coke. In turn, this reacted upon the volume of freight to be handled by the railways, causing thereby a very great reduction in the consumption of fuel in the locomotives. . . . In the Coast district the war made itself felt through different channels, as there were not any smelteries in operation there, but the activity of German cruisers so affected trans-Pacific shipping as to greatly reduce the quantity of coal used for this purpose. . . . It is claimed that much more coal could have been produced by Vancouver Island collieries had there been a demand for it."

As to 1915, the chief loss in production was in the Crowsnest district, caused in large measure by the Hosmer mines having been closed and by a lessened output from the Corbin colliery, these together showing a decrease of 123,825 tons, against which there was an increase of 18,607 tons from the Crow's Nest Pass Coal Company's mines, leaving a net decrease of 105,218 tons. This company now has some of its mines in such good condition that it could have produced, without difficulty, had there been a market for it, fully twice as much coal as it did. There was a generally reduced output from the relatively small mines of Nicola and Similkameen districts, their total production having been only 101,060 tons as compared with 138,931 tons in 1914. These mines are at a disadvantage in being situated at a comparatively long distance from populous or manufacturing centres. The production of several of the Vancouver Island mines was smaller than in 1914, the Vancouver-Nanaimo Co.'s output having been 61,000 tons less; that of the Canadian Collieries Company's Comox mines 34,000 tons less, and that of the Pacific Coast Coal Mines, Ltd.,'s South Wellington mine (which was flooded for several months) nearly 26,000 tons. Against these decreases there was an increase of nearly 101,000 tons from the Western Fuel Co.'s mines, of which 28,000 tons was from its new Reserve Shaft mine; 35,000 tons from the Extension Colliery mines of the Canadian Collieries, Ltd., and 22,500 from the new Morden mine of the Pacific Coast Coal Mines, Ltd. The net result was an increase of about 37,500 tons as compared with the output of 1914, the totals for the two years having been approximately 1,109,800 long tons in 1915 against 1,072,300 tons in 1914.

Production of Coal in British Columbia in 1915.

		Tons of 2,240 lb.
Vancouver Island:		
Canadian Collieries (Dunsmuir) Limited		
Comox Mines (Cumberland)	360,410	
Extension Mines	164,365	524,775
Western Fuel Co—		
Nanaimo Mines	382,604	
Reserve Shaft Mine	28,866	411,470
Pacific Coast Mines, Ltd.—		
South Wellington	105,000	
Morden Shaft Mine	22,500	127,500
Vancouver-Nanaimo Coal Mining Co.		46,034
		1,109,779
Nicola:		
Middlesboro Collieries	54,500	
Inland Coal and Coke Co.	32,820	
Pacific Coast Colliery Co. of B. C	1,065	88,385
Similkameen:		
Princeton Coal and Land Co.		12,675
Southeast Kootenay:		
Crow's Nest Pass Coal Co.	707,010	
Corbin Coal and Coke Co.	52,955	849,965
Gross production of coal		2,060,804

Of this coal, about 409,000 tons was made into coke—nearly 360,000 tons at the Crow's Nest Pass Coal Co.'s ovens at Fernie and Michel, Southeast Kootenay, and

the remainder at the Canadian Collieries Company's ovens at Union Bay, Vancouver Island. The quantity of coke made was about 248,000 long tons, of which 239,000 tons was made in the Crow's Nest district and 9,000 tons on Vancouver Island. The ovens at Union Bay had been inoperative for several years until, in 1915, they were again used, this time to supply coke for the Granby Consolidated Company's new smelting works at Anyox, Observatory Inlet.

After deduction of the amount of coal made into coke, the net quantity to be taken into account as part of the mineral production of British Columbia in 1915 is approximately 1,652,000 tons. While there will be some changes made after the final returns for the year shall have been received, it will not be sufficient to considerably affect the total, as here given. The net production of coal in 1914 was 1,810,967 long tons, so that there will be a net decrease for 1915 of about 159,000 long tons. On the other hand, there will be a gain in coke, for against a production of 234,577 long tons in 1914 the estimated quantity for 1915 is 248,424 tons. Shown in money, the difference in value between the production of coal and coke combined in 1914 and 1915 will be $473,303, the respective totals being $7,745,847 for 1914 and an estimated total of $7,272,544 for 1915.

VANCOUVER ISLAND COLLIERIES.

Western Fuel Co.—Of the Vancouver Island coal mines, those of the Western Fuel Co. made a substantial increase in output in 1915 as compared with 1914, their total for 1915 having been 411,470 tons against 310,564 in 1914, a gain of 100,906 tons—72,514 tons from the Nanaimo mines and 28,392 tons from the new mine known as the Reserve Shaft mine. The increase would, doubtless, have been considerably larger but for a disastrous explosion which for some time seriously interfered with production from the Reserve mine. The company's Nanaimo operating mines include the No. 1 or Esplanade Shaft and the Protection Island mine. A brief official description of these mines, which are connected underground, is as follows. "No. 1 mine is situated at the south end of the Esplanade, in the city of Nanaimo, and has been in operation for many years, with good prospects for many years to come. The present operations are at a depth of 600 to 1,200 ft. below the surface, with a large submarine area. This mine has three openings, namely, the main hoisting (No. 1) shaft, Protection and Newcastle Island shafts. These shafts are connected and are part of the Douglas and Newcastle seams, and all are equipped with hoisting apparatus in case of emergency.

"The Newcastle seam is from 3 ft. to 3 ft. 6 in. in thickness, and is of a very hard nature; it is worked on the longwall system, to which it is well adapted. It is 60 to 70 ft. deeper than the thicker Douglas seam which, it is of interest to note, was first opened when, in 1884, No. 1 shaft 17 ft. and No. 2 14 ft. in diameter were sunk to it after a bore-hole, which was put down in 1881, had shown the seam to be at a depth of 650 ft. and to there be 8 ft. 6 in. in thickness. In 1887 No. 2 shaft was deepened and at 71 ft. below the Douglas seam it entered the Newcastle seam, there about 6 ft. thick. It will thus be seen that these Nanaimo mines have been producers of coal for more than 30 years. The Reserve mine is distant from Nanaimo about five miles. The shaft is in the centre of a 2,500-acre virgin coalfield. Sinking was commenced in 1910, and coal was reached, at a depth of 1,043 ft., in April, 1913. Main and auxiliary shafts 350 ft. apart were afterward connected. The coal, where cut by a rock tunnel from the shaft, showed 14 ft. in thickness of the Douglas seam, the coal being clean, firm, and of good quality. Ventilation of the two shafts was provided for by a pair of 90-in. Sirocco fans connected to a 24 by 30 engine by a rope-drive and standing on substantial concrete foundations 80 ft. distant from the shaft with two concrete tunnels having a total area of about 110 sq. ft. The surface equipment is modern, with tipple and screening plant at the main shaft. The tipple building is a commodious structure, and the handling capacity of the plant is 2,000 tons of coal in nine hours.

Canadian Collieries.—The Canadian Collieries (Dunsmuir) Limited, operates two collieries, namely, Comox and Extension. These collieries were previously owned and operated by the Dunsmuir interests but were acquired in 1911 by the organizers of the Canadian Collieries.

The mines of the Comox colliery are situated in the neighborhood of Cumberland, about 70 miles north of Nanaimo. A standard-gauge railway connects the mines with the seaboard at Union Bay, where there are a coal-washer and a battery of coke-ovens. The mines that have been worked in recent years are Nos. 4 and 7 slopes and Nos. 5, 6 and 8 shafts. There has not been much change since 1913, when electric power was substituted for steam, much new machinery and mine and railway equipment put in, and considerable underground development work done. Before all this preparation for increased production of coal was completed labor troubles were experienced, commencing in the autumn of 1912 and continuing throughout 1913, and these adversely affected the supply of fuel to markets then open. Since these difficulties have been overcome there has not been a sufficiently large demand for coal to admit of the mines being worked anything like full time. The changed conditions are shown by the production figures over a series of five years. For 1911, 1912, and 1913, respectively, the gross output of coal from these mines was 437,335, 475,803, and 508,095 long tons; for 1914 it was 394,731 tons, and the estimate for 1915 places the quantity at 360,410 tons. As compared with 1914, last year's production shows a decrease of 34,321 tons. The successful conclusion of negotiations with the Granby Consolidated Co. for the supply of coke for its smelting works at Anyox, on the Pacific coast, provided means for profitable use of between 45,000 and 50,000 tons of slack. Speaking generally, the plain fact is evident, that there was not a market for anything like the quantity of coal that could have been produced at Cumberland had there been a considerably larger demand for it.

At the company's Extension mines, of which four have been in operation in late years, there was an improvement over the conditions that obtained in 1914, for the increase in output in 1915 was 35,149 tons, which a little more than compensated for the decrease at Cumberland, leaving the net increase from the whole of the company's mines at 828 tons.

Pacific Coast Coal Mines, Ltd.—The flooding of this company's South Wellington mine early in the year, water from a nearby old mine having broken through into it, caused a suspension of output of coal from workings previously productive, the result having been a decrease from South Wellington of 25,645 tons. However, the company's new Morden Shaft mine produced 22,500 tons, so the net loss was only 3,145 tons. The South Wellington mine production figures for the two years were 130,645 long tons in 1914 and 105,000 (estimated) in 1915. In 1911, however, an output of

205,048 tons was made, so this company, like others, has suffered from the unfavorable conditions of quite recent years.

Much progress has been made in developing and equipping the company's Suquash colliery, in the northern part of Vancouver Island.

Vancouver-Nanaimo Coal Mining Co.—This company operates the Jingle Pot mine, New East Wellington colliery, situated about two miles from the city of Nanaimo, working on the coal seam known as the Old Wellington seam. Its production in 1915 was the smallest for five years or more—only 46,034 long tons, against 107,158 tons in 1914. In the official report for 1914 the district inspector of mines reported "no development work is in progress. All places have reached the boundary, and we are coming back extracting pillars." Probably similar conditions are accountable for the decrease in output in 1915.

NICOLA AND SIMILKAMEEN.

Three collieries produced coal in Nicola district in 1915, but there was a decided falling off in the total output, which was only 88,385 tons against 114,546 in 1914. The Middlesboro Colliery produced 54,500 tons, the Inland Coal and Coke Co. 32,820 tons, and the Pacific Coast Colliery Co. 1,065 tons. The corresponding figures for 1914 were 60,705, 53,281, and 560 tons. The net decrease, therefore, was 26,161 tons. Slackness of coal trade and high railway freight charges are held accountable for the non-progressive conditions obtaining here.

In Similkameen district, only the Princeton Coal and Land Co. made any production, and the output from its mine at Princeton was but 12,675 long tons as compared with 19,535 tons in 1914 and 29,206 tons in 1913. There is, however, a decided improvement in the fact that recently another railway was completed and commenced operating, and this gives Princeton coal access to several markets previously practically inaccessible to it, since only long and roundabout railway connections were available, with a correspondingly high freight charge that was really prohibitory. The prospects, therefore, are now believed to be more promising than at any previous time since the company commenced to mine coal.

The Coalmont colliery was closed throughout the year, awaiting money for continuing development and providing machinery and other equipment and transportation facilities between mine and railway. Here again confidence is felt that the outlook is better now that there is a competing railway and more provincial markets accessible.

SOUTHEAST KOOTENAY COLLIERIES.

The closing of the Hosmer colliery in 1914 left but two coal-mining companies operating in this district, namely the Corbin Coal and Coke Co. and the Crow's Nest Pass Coal Co. The loss of production from the Hosmer mines has made a considerable difference in the total output of the district, since the Canadian Pacific Railway Co. does not take from other mines in the British Columbia part of the Crow's Nest district coal to compensate for that it formerly took from the Hosmer colliery. In 1914 the Hosmer mines made an output of 102,468 tons against nil in 1915. A reduced output from the Corbin mines made the decrease larger, and this was only in small degree offset by an increase of 18,607 tons from the Crow's Nest Pass Coal Co.'s mines, so that the net decrease was 105,218 long tons, the district total having been 849,965 tons in 1915 as compared with 955,183 tons in 1914.

Corbin Coal and Coke Co.—This company operated two mines, namely No. 4 mine, situated near the tipple, and No. 3 mine, also known as the "Big Showing," worked both on the surface and underground. At the latter, surface operations are carried on when there is not any snow to impede the work by the open-cut or quarrying system, the coal being loaded by hand into one-ton bottom dump cars which are emptied into railway cars nearby. Output from No. 3 was 24,210 tons, and from No. 4 underground workings 28,745 tons, total 52,955 tons, against 74,312 tons in 1914.

Crow's Nest Pass Coal Co.—This company in 1915 worked eight mines at its Coal Creek colliery and four at its Michel colliery. Coke ovens were operated at both Fernie and Michel. Its gross output of coal was 797,010 tons, against 778,403 tons in 1914, an increase of 18,607 tons. The quantity of coke made was 239,178 tons, as compared with 199,866 tons in 1914, an increase of 39,312 tons, which more than compensated for the loss of production at the Hosmer ovens that in 1914 made 34,711 tons.

Of the eight mines operated at Coal Creek in 1915, that known as No. 1 East, one of four on the south side of the valley, was the largest producer. It is at an elevation of 90 ft. above the central tipple and 800 ft. east of it. It was opened by means of a rock tunnel which cut the coal at 215 ft. from the entry. Both main and counter tunnels were driven 3,500 ft. toward the south. The cost of upkeep of the return airway having been considerable owing to pressure of the upper part of the large seam (the airway had been driven in the lower part of the seam), the timbers were drawn and the top coal to the main roof was dropped. The roof is of hard sandstone, so no timber is required to keep it up; the permanent air-course now provided will cost little to keep it in good order. Late in the year there was installed an endless-rope haulage system, operated by an engine placed outside the mine, to deliver the coal from the inside of the mine to the central tipple.

Much good work has also been done in the company's mines at Michel colliery, which like Coal Creek, now is in shape for production on a much larger scale than in past years, large new coal-areas having been opened. Of the four mines in operation, that known as New No. 8 is most noteworthy. No. 8 seam has been redeveloped above old No. 8 workings sealed off on account of fire. Two tunnels have been driven and from these a four-way system of levels is projected, the two lower now well on the way, and Nos. 3 and 4 being developed by the advancement of backway incline raises that are being driven. A three-track tram line connects with a Phillips crossover tipple at the head of a gravity incline down to the endless-haulage system, thence to the main tipple. A pair of counterbalanced 7-ton skips operated from two 8-ft. drums controlled directly from the top loading-station and automatically loading and discharging are capable of handling under active working conditions 300 tons of coal an hour. The extension of coal-producing operations into the large field here entered constitutes one of the most important recent developments at the Michel colliery.

GOLD MINING IN YUKON IN 1915

According to the Dawson Daily News the Yukon Territory has contributed to the outside world approximately $185,000,000 in virgin gold. This magnificent sum has come chiefly from the placers within fifty miles of Dawson. Other rich creeks within 100 miles of Dawson have furnished the bulk of the remainder, while the remaining portion has come from more distant locations.

The record shows a fluctuating output during the ten years previous to the famous discovery on Bonanza Creek in 1896, a tremendous yearly increase until the banner year of 1900, and a gradual decrease until the lowest ebb was reached in 1907, and then began a continued upward leap due to the installation of hydraulics and giant dredges. Since 1910 the fluctuation has been but slight, and the shipments from Dawson have approximated $5,000,000 annually. In 1914 the slight shrinkage was accounted for to considerable degree by the breaking down of one of the largest dredges just as it got into the best of pay. The same dredge has been out of commission all of this season, undergoing repairs, and it is not certain when it will resume work, so that it is not aiding in this year's totals. Another dredge which worked most of last year on Bonanza is idle this year. But, notwithstanding the idleness of the two dredges, a splendid showing is being made.

The 1915 production is estimated at $4,750,000, a slight increase over that of 1914.

"**The Yukon Gold Company's dredges** have been in some of the richest ground this year that they ever worked, and, as a consequence, the total yield for this season of the Klondike camp is ahead of last year. The Yukon Gold Company worked one virgin claim, No. 21, on Eldorado, this season, from which an enormous sum was taken. The claim was bought in the early days of the camp by John J. Healy, the veteran frontiersman, for the N. A. T. & T. Co., and never was worked, so that when the dredge got to work there this year it found the pay as rich as custard. Representatives of the two companies say nothing of the total clean-up, but rumor has it that the dredge got fully half a million dollars in virgin gold out of the ground.

"Some Eldorado claims yielded much better than that by old methods. Tom Lippy, of Seattle, is said to have cleaned up more than a million and a half from No. 16 Eldorado, and No. 17, which was owned by Jim Hall, was a marvellous producer. Both of these claims, like nearly all the best Eldorado properties, were worked by steam thawing and hoisting methods. The old system required five or six years to work out a claim, whereas the dredges now work out several of the claims in a single season, and take up several feet of bed-rock and get therefrom much gold which the miners by the old methods could not get.

"The yield now is slightly lower than a year or two ago. Bonanza and Eldorado are now worked by new methods, to a large extent, and other creeks which have been under preparation for the new methods are expected to begin yielding in another season.

"**The Treadgold properties**, totaling many miles, on Dominion and Quartz creeks, have been in preparation for several seasons, and the first excavator or machine for working there on the large scale has just arrived. It is now being hauled to the creek, and is to be set up this fall. Mr. Treadgold is expected to arrive here this fall to see it work. The machine was worked in England as a test before being sent here. Similar excavators are used for other classes of mining on an extensive scale in other parts of the world.

Producing Creeks.—"The gold is extracted from the Klondike river, between Bear and Bonanza creeks, and from Bonanza, Eldorado, Hunker and Gold Run creeks. The largest hydraulics are along Bonanza benches. Milvain is working a dredge on Miller creek. Individual production also comes from Sulphur, which now leads in activity on old time creeks near the city and elsewhere in the territory.

"It has been estimated by some that the placers in the old Klondike district, that is, within fifty miles of Dawson, still contain $130,000,000 to $150,000,000. The Treadgold property of Indian river, Dominion creek, Quartz creek, Sulphur and tributaries alone aggregating 75 miles or more, have been estimated in the company's prospectus to contain fully 300,000,000 cubic yards carrying 30 cents to the yard, or $90,000,000. It was stated some time ago that eight miles of gravel between Bear and Bonanza creeks, on the Klondike, remaining to be worked and carrying gravels worth 22 cents a yard, contain fully $20,000,000. The Yukon Gold Company's properties remaining in the camp are believed to contain fully that much, if not far more. They include, besides properties on Hunker, Eldorado and Bonanza yet unworked, a large portion of Gold Run. Upper Gold Run, comprising 70 claims, also is practically unworked. Many other creeks in the territory being worked by individuals may yet yield millions.

Possible Dredge Propositions.—"Creeks which have been looked on as possible dredge propositions, but which are yet in the hands of individuals, include Gold Bottom, Allgold, Eureka, Clear, Barlow, Scroggie, Mariposa, Henderson, Barker, Thistle, Britannia, Canadian, Nansen, Livingstone, Big Salmon, some of the Kluane creeks, Highet and several others of the Mayo district and a long mileage on McQuesten, many miles of Fortymile and tributaries, while below the Yukon boundary are numerous creeks in the gold belt in the Circle district, including Independence, Mammoth, Mastodon, Woodchopper and Coal creeks; the several creeks about Eagle and others out of which individuals have taken much gold.

"If the Treadgold excavator works as estimated it will bring many of the lower grade creeks into the producing zone, which years ago never were dreamed of as being workable at a profit, but which are indicated to contain such pay that were they in a thawed zone would produce multiplied millions even by the old dredge methods. Some predict that ground sluicing and scraping or excavating methods, if not dredging, will yet win their golden treasure and good profits to the operators."

"Scotty" Allan, a well-known driver of racing dogs in Alaska, has returned to America from France, whence he went with about 400 malamutes from Alaska and Labrador, for which the price was $100 each. Some of the dogs had been winners of long distance races over frozen trails in the Nome region, Alaska. Mr. Allan was in Montreal at the end of December and went thence to Berkley, California, to visit his family before returning to Alaska.

ALLOY STEELS*

By George L. Norris.

Steel can broadly be defined as an alloy of iron and carbon that can be forged and rolled. From expediency and necessities of manufacture, certain impurities beneficial or otherwise are present, but not in sufficient amounts to materially alter the characteristics of the pure alloy of iron and carbon.

Under this definition, steel, or as it is now often referred to, carbon steel, is usually within the following maximum composition: Carbon, 1.50 per cent.; manganese, 1.00 per cent.; silicon, 0.35 per cent.; phosphorus, 0.05 per cent.; sulphur, 0.05 per cent.

An "alloy" steel is steel alloyed with one or more metals, in sufficient amounts to influence or change the characteristics of steel, and still possible of forging or rolling.

The usual steel alloying metals are manganese, silicon, nickel, chromium, tungsten and vanadium. As these metals will all alloy with each other, it is evident that it is possible to obtain a great variety of alloy steels.

Steel containing upwards of 1.50 per cent. manganese is not commonly considered an alloy steel, although this percentage of manganese undoubtedly has some effect on the characteristics of steel. This is due no doubt to the fact that manganese is always present in steel.

The alloy steels are usually divided into two groups: "ternary" steels, with one metal alloyed, and "quarternary" steels, with two metals alloyed. The more complex alloy steels are practically limited to high-speed tool steels.

The general characteristics of alloy steels are high elastic limit and great strength, combined with a high degree of toughness as compared with the carbon steel with which they are alloyed. The strength and hardness can be enormously increased by heat-treatment (quenching and tempering) and still have the steel retain great toughness.

Alloy steels are not as a rule placed in service in the condition as forged or rolled. The forging and rolling temperatures are usually so high that the steel requires heat-treatment to refine the grain and develop the exact combination of strength, hardness and toughness desired. It is frequently necessary to anneal after forging in order to facilitate machining operations. This, of course, necessitates subsequent heat- treatment.

Most of the alloy steels are of medium or low carbon content. The corresponding simple or carbon steels are only slightly or moderately improved in strength by heat-treatment.

The use of alloy steels in cutting tools dates back nearly a hundred years, although it was not until after 1850 or 1860 that alloy steels for this purpose became firmly established.

With the advent of iron clad warships began the struggle for supremacy between projectile and armor plate that has been so fruitful in the development of alloy steels. Chromium, nickel and nickel-chromium steels are largely the result of this struggle.

The publication in 1888 by Hadfield of the results of an extensive research of the alloys of manganese and steel, which resulted in the discovery of a remarkable new alloy steel, marks a period of active investigation into the effect of other metals on steel. The most important of these were the investigations on nickel steels by James Riley in 1889, which demonstrated that a mild open-hearth steel, such as used for structural, general forging and machinery purposes, when alloyed with 3 to 4 per cent. nickel had considerably higher elastic limit and tensile strength, with practically the same or greater ductility. One of the earliest and most extensive applications of nickel steel was for armor plate. For many years nickel steel was the principal alloy steel in use.

During this same period referred to, Hadfield made investigation of the effects of silicon on steel, and also a very complete study of chromium steels, which for some time had been used in a small way for springs and special forgings, but principally for tools and armor piercing projectiles.

The development of high-speed steel about 1900, making it possible to readily machine heat-treated alloy steels, and the advent of the automobile with its demand for superior steel, have brought about the present extensive use and development of alloy steels.

The automobile industry, with its demand for steel of high strength and durability, has been undoubtedly the most important factor in the development of commercial alloy steels, and the largest consumer. Alloy steels are used extensively for transmission gears and shafting, axles, steering levers and spindles, spring chassis frames, crank shaft, cam shaft, connecting rods, valves, and many other parts of automobiles.

They are also extensively employed in forgings for high-speed engines, marine engines, locomotives, electrical machinery, mining machinery and other mechanical engineering structures.

The use of alloy steels in bridge construction has been limited, but there is undoubtedly a field in long-span bridges for an alloy steel of high strength that can be used in the condition as rolled, preferably, or at most with a simple annealing.

Coincident and having a marked influence on the development of alloy steels, was the discovery of large deposits of vanadium ore in Peru, thus assuring a source of supply at a reasonable cost of this rare metal, which is the most powerful yet discovered for alloying with steel, that is, in small amounts.

The most important of the engineering or constructural alloy steels are those containing nickel, chromium and vanadium, singly or in combination. With all these steels it is possible, through heat-treatment, to obtain a tremendous range in strength, in round numbers varying from 100,000 to 250,000 pounds per square inch, depending also, of course, upon the size of the section.

It is not possible nor within the province of this paper to go deeply into the technology of alloy steels, but only to briefly describe the principal alloy steels and their characteristics.

Manganese Steel.—This steel usually contains 10 to 13 per cent. of manganese and approximately 1 per cent. of carbon. It is practically non-magnetic and has a peculiar hardness to which it owes a remarkable resistance to abrasion. It is extremely difficult to machine. It has high strength and toughness, but rela-

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tively low elastic limit. With care it can be forged and rolled. It has found its principal application in castings for crushing and grinding machinery and railroad crossings. Manganese steel has the peculiar property of being toughened and softened by quenching in water, resembling copper in this respect. All manganese steel castings are subjected to this treatment to remove brittleness.

Silicon Steel.—There are two types of silicon steel, one of which has found some application as an engineering steel. This steel, frequently called silico-manganese steel, is generally covered by the following limits of composition: Carbon, 0.45 to 0.65 per cent.; silicon, 1.50 to 2.00 per cent.; manganese, 0.50 to 0.80 per cent.; the manganese is normal, contrary to what is indicated by the name. The principal application of this steel is for automobile springs, and to some extent for gears. It fibres readily through heat-treatment, and is very brittle in the direction at right angles to rolling. It is very sensitive to heat-treatment. and a relatively small variation in annealing temperature after quenching has a strong effect on the results obtained.

The other type of silicon steel contains 3 to 5 per cent. silicon, is low in carbon and manganese and is extensively used for electrical transformer sheets on account of its high permeability and electrical resistance. It is weak and has no constructural value.

Nickel Steel.—Nickel alloys with steel in all proportions, but by far the most important nickel steel, from an engineering standpoint, is the law and medium-carbon steel with 3 to 4 per cent. of nickel, commonly known as 3½ per cent. nickel steel. The presence of manganese in nickel steel is very essential, as it has a marked effect on the mechanical properties. The amount of manganese should range from 0.50 to 0.80 per cent. This steel has been extensively used since its introduction in 1889, and is a good all-round engineering and structural steel with considerably higher elastic limit and tensile strength than the corresponding carbon steel. and with practically the same degree of ductility. The low-carbon steel, 0.10 to 0.20 per cent. carbon, is used extensively for case-hardening parts. It case-hardens more readily than carbon steel and gives a harder casing with a strong, tough, fibrous core. A great deal of nickel steel with carbon from 0.20 to 0.35 per cent. has been used in shapes and plates as rolled, and in annealed eye-bars for bridge construction. In this condition, which is not to be recommended for forgings, the following are typical physical properties: Elastic limit, 45,000 to 60,000 lbs. per sq. in.; tensile strength, 80,000 to 100,000 lbs. per sq. in.; elongation in 2 inches, 20 to 15 per cent.; reduction of area, 40 to 25 per cent. Annealed nickel steel forgings have only slight advantage in strength over carbon steel, and consequently are not advantageous either from an engineering standpoint or commercially unless heat-treated. With heat-treatment it gives considerably higher strength than carbon steel, combined with greater ductility or toughness. It does not give as high values as the nickel-chromium and chromium-vanadium steels. Nickel steel rolls and forges readily and machines easily. It develops a very thick, hard scale which is apt to give considerable trouble in drop-forging and is hard on the dies. Nickel steel is also very liable to develop seaminess, especially when made in large heats and cast into large ingots, as is now customary. It requires a larger discard to ensure soundness. The use of nickel steel in forgings, and particularly drop-forgings, is falling off in favor of other alloy steels with greater values.

Chromium Steel.—The use of this steel is confined principally to a few specialties and it is not in general use as an all-round engineering steel. One of the principal uses is for balls and ball races. The great mineralogical hardness obtained by quenching is very desirable for this purpose. The steel for this application contains approximately 1 per cent. each of carbon and chromium.

Chromium steel is also used for stamp-mill shoes, and in combination with soft steel in laminated plates for construction of burglar-proof safes, and in the same combination in bars for jails.

The low- and medium-carbon types, containing 0.80 per cent. or less of chromium, have somewhat higher mechanical properties than the corresponding carbon steel. It is not used to any great extent, other alloy steels being superior, both in static and dynamic strength. Chromium steel is also very liable to crack and check in heat-treatment.

Nickel-Chromium Steel.—The addition of chromium to nickel steel has a marked effect, greatly increasing the strength and resistance to shock and particularly the mineralogical hardness. It is more difficult to forge and heat-treat and harder to machine, and is also liable to the seaminess frequently present in nickel steel. There are three types of this steel, differing both in the percentage of nickel and chromium, and all with low or medium carbon:

	Nickel	Chromium	Carbon
1st.	3.5 p.c.	1.50 p.c.	0.25 to 0.45 p.c.
2nd	2.0 p.c.	1.00 p.c.	0.10 to 0.45 p.c.
3rd	1.5 p.c.	0.50 p.c.	0.10 to 0.45 p.c.

The first type is used principally for armor plate and armor-piercing projectiles and came into use about 1895, superseding the nickel plates and chromium projectiles. The other two types were developed by the automobile industry. The second type is largely for automobile forgings. It gives high strength with heat-treatment, has great hardness and good shock and fatigue resisting qualities. The third type is a largely used all-round engineering steel. It is used for automobile forgings and for a variety of miscellaneous drop-forgings and machine parts. It is an excellent case-hardening steel, carbonizing readily. This type is more tractable in working, heat-treating and machining than the other two. It is also somewhat lower in tensile strength.

Vanadium Steel.—The addition of small amounts of vanadium, generally under 0.25 per cent., to simple carbon steel or any of the alloy steels increases very considerably—about 30 per cent. or more—the elastic limit and breaking strength, without materially affecting the ductility. To an even greater extent it increases the resistance to shock and fatigue.

The vanadium steel which has been up to now most generally used is a chromium-vanadium steel of the following typical composition: Carbon, 0.10 to 0.55 per cent.; manganese, 0.50 to 0.80 per cent.; chromium, 0.80 to 1.00 per cent.; vanadium, over 0.15 per cent.

The lower carbon type, 0.10 to 0.20 per cent., is used mainly for case-hardening and is the best steel for this purpose. It carbonizes readily, gives the highest maximum carbon and finest grain. The casing is very strongly coherent to the core, very hard, tough and strong and practically free from any tendency to flake or powder. The core is remarkably strong and tough.

The higher limits of carbon, 0.45 to 0.55 per cent., are extensively used for automobile and locomotive

springs, giving remarkable resiliency and endurance. It is also extensively used for oil-tempered gears.

The range in carbon from 0.35 to 0.45 per cent. is largely employed for crank shafts, locomotive axles, crank pins, connecting rods, hammer piston rods, automobile transmissions and rear axle shafts.

The range from 0.25 to 0.35 per cent. carbon is used for automobile forgings of all kinds and a great variety of miscellaneous work requiring the best combination of static and dynamic strength.

As illustrating the wonderful shock and fatigue enduring qualities of chrome-vanadium steel, drop-hammer piston rods of this material are giving many times the length of service of carbon, nickel and chromium-nickel steel rods.

Vanadium steels have a much wider heat-treatment range than other steels. The desired physical properties can be obtained with a higher draw-back or annealing temperature, which is very advantageous as more completely removing quenching strains, and also as a manufacturing proposition.

Chromium-vanadium steel forges and machines better than nickel-chromium steel, is not as liable to injury in heating for forging, is not so liable to crack or check in heat-treatment and is free from the seamy tendency of steel containing nickel.

Carbon steel with a small percentage of vanadium, from 0.15 to 0.20 per cent., has been used extensively for locomotive frame castings with great success. The failures of these frames from all causes over a period of nearly ten years has been only a fraction of one per cent.

In tool-steel grades, this steel has better cutting qualities, hardens deeper and more uniformly, and has remarkable toughness. In what are termed battering tools, chisels, cutters, dies, etc., it gives several times the length of service of ordinary carbon tool steel.

The handicap of high cost of vanadium has almost disappeared, and simple carbon-vanadium steel in the ordinary forging grades will undoubtedly soon become very widely used as an all-round engineering steel, when a better steel than carbon is required. It is remarkably clean and is as easily worked as carbon steel. It is free from the seaminess and ugly scale of nickel steels and the tendency to check and crack of the chromium steels, particularly nickel-chromium.

Tests of carbon-vanadium steel rails in curves are showing about 20 per cent. less wear than rails with 0.15 to 0.20 per cent. higher carbon, and are also considerably stronger. This difference in wear will doubtless be much greater when the carbon percentage in the vanadium rails is increased to that of the standard rails.

In simple annealed forgings, plain vanadium steel has physical properties well above those specified for heat-treated (quenched and tempered) carbon steel.

This type of vanadium steel has a wider range of quenching temperature than nickel or nickel-chromium steels; and for mechanical properties after heat-treatment is practically on an equality with 3½ per cent. nickel or the low nickel-chromium steels in general use, and apparently has higher fatigue resisting qualities.

While nickel and chromium interfere seriously with the welding quality of steel, vanadium does not, but on the contrary improves this quality. Vanadium steel wire is in common use for autogenous welding.

Tungsten Steel.—This is principally used for magnets for magnetos and to some extent in hack saws and special tool steels. Tungsten is seldom used in engineering constructional steels, and then usually in combination with chromium.

Complex Alloy Steel.—Practically none of the constructional steels contain three or more alloy metals. The only steel in this class to be considered is what is commonly known as high-speed steel. Robert Mushet developed and patented about 1860 an air-hardening steel that was very much superior to carbon tool steel for machining hard material. Mushet steel, as it was known, had about the following composition: Carbon, 2.00 per cent.; manganese, 1.75 per cent.; silicon, 0.75 per cent.; chromium, 0.40 per cent.; tungsten, 5.50 per cent.

At the Paris Exposition in 1900, the Bethlehem Steel Co. exhibited a new tool steel that took wonderfully heavy cuts at high speeds, the point of the tool heating up to a strong blue color without losing its edge. This steel, which immediately became known as high-speed steel, was the culmination of the research work carried on for many years by Mr. F. W. Taylor and later published in his monograph "The Art of Cutting Metals." The difference between this steel and Mushet steel is apparent from the following typical composition: Carbon, 0.60 per cent.; manganese, 0.20 per cent.; silicon, 0.10 per cent.; chromium, 4.00 per cent.; tungsten, 18.00 per cent. With this steel, cutting speeds of over 90 feet per minute were obtained.

Within three or four years it was found that the addition of vanadium to high-speed steel made it possible to still greatly increase the speed and size of cut. At first only about 0.30 per cent. vanadium was added, but this has been increased until now 1.00 per cent. is practically the standard amount in most high-speed steels, and speeds of 140 feet and upward per minute have been attained.

Lately the addition of cobalt to high-speed steel has been meeting with favor as still further improving the endurance of the steel. The amount of cobalt generally used is 3 to 4 per cent., with no change in the percentage of the other metals—tungsten, chromium and vanadium.

DIVIDENDS PAID IN 1915.

Excluding the Mond and International nickel companies operating in Ontario, Canadian mining companies paying dividends in 1915 included: Beaver, $120,000; Caribou Cobalt, $115,000; Coniagas, $600,000; Crown Reserve, $141,505; Consolidated Mining and Smelting Co. of Canada, $464,352; Dome, $400,000; Granby, $449,955; Hedley, $300,000; Hollinger, $1,560,000; Kerr Lake, $450,000; La Rose, $412,122; Le Roi No. 2, $58,320; McKinley-Darragh-Savage, $269,723; Mining Corporation of Canada, $518,750; Nipissing, $1,200,000; Nova Scotia, $127,200; Peterson Lake, $189,000; Porcupine Crown, $240,000; Rambler, $35,000; Seneca-Superior, $335,218; Standard, $250,000; Temiskaming, $75,000; Rea Mines, $12,000, and Tough-Oakes, $65,187. Considering that 1915 was a poor year for the silver mining companies, these figures indicate that mining is being very profitably carried on in Canada. They fail to show, however, more than one-half the profits. The two companies operating nickel-copper mines in the Sudbury district made alone profits nearly equal to the total dividends paid by the above mentioned mining companies.

MINING CUPRIFEROUS PYRITES IN QUEBEC*

By J. Austen Bancroft.

In the history of copper mining in the Eastern Townships, the year, 1909, should always be prominent because of the discovery of the McDonald or Weedon mine in Weedon township, Wolfe County. The rusty appearance of quite extensive outcrops of sericite schist had attracted the attention of prospectors for several years, but no work had been done, because of the prevalent belief that only disseminated particles of pyrite were present in the schists. In the autumn of 1908, Mr. John McDonald of Sherbrooke, purchased the property, and during the following winter and spring, sank several pits in the rusty schists. It was not until the latter part of August, 1909, when, abandoning the rock outcrops, he began to excavate in the bottom of a grass-covered depression, elongated in a direction identical with the strike of the schists, that a body of cupriferous pyrite was discovered. Here, a shaft, 8′ by 8′, penetrated solid ore to a depth of about 25 feet. The property was leased under option to Dr. Pierre de Pierre Ricketts of New York, who later transferred it to the East Canada Smelting Company. According to the agreement of option, this Company paid Mr. McDonald $100,000 for the property.

The first shipment was made from the Weedon mine on August 2nd, 1910, and during the balance of the year 6,112 tons of ore were sent to market. Since that time the shipments (in tons of 2000 lbs.) from this mine, as compared with the total shipments of cupriferous pyrite from this district have been as follows:—

Year	Total shipments from Eastern Townships	Shipments from Weedon mine
1910	24,040	6,112
1911	38,554	23,700
1912	62,107	33,130
1913	87,550	52,000
1914	117,778	59,058
	330,029	174,000

Thus during the past five years, the Weedon mine has produced 174,000 tons of the total of 330,029 tons of cupriferous pyrite that have been shipped from the Eastern Townships.

At intervals, from 1911 to 1914, about 1800 tons of copper ore have been shipped from the Ives mine, near Eastman. In 1914, 1600 tons of pyrite, carrying only a trace of copper, were shipped from the deposit near Stratford, six to seven miles from St. Gerard station on the Quebec Central railway. The Eustis mine was the only other property from which ore was exported during this period, so that the amount shipped from the Eustis for the years 1910 to 1914, inclusive, has been about 154,249 tons.

The main ore-body of the Weedon mine is a lenticular mass of cupriferous pyrite with which very small amounts of galena and zinc blende are associated; it has proved to be 570 feet in length with a maximum thickness of 40 to 45 feet, and striking N 37° E, dips 40° to 45° to the southeast. On the average the north-eastern portion of the lens has been found to carry somewhat higher values in copper than the south-western. Three shafts have been succesively sunk on the vein to depths of 96, 350, and 470 feet. At first, the ore was taken by teams from the mine to the railway, a distance of 5 miles, at a cost of about 80 cents per ton. In 1912, a Bleichert aerial tramway, 19,500 feet in length, was constructed from the mine to the railway, at a cost of $1.75 per foot, and the cost of transporting the ore to the railroad thus has been reduced to 6.7 cents per ton. From January 1st to September 1st, 1914, 50,000 tons of ore was shipped, the maximum monthly shipments being those of June and July of 7050 and 7220 tons, respectively. Up to date, the ore has averaged 3.62 per cent. of copper, 40.74 per cent of sulphur, 0.77 per cent. of zinc, a trace of lead, and 0.46 oz. of silver and .01 oz. of gold per ton. The ore shipped has been sold for about $9.00 a ton, payment being made on the sulphur and copper contents.

At present, the Eustis mine is working at a depth of about 3,900 feet on an average incline of 38°. In 1912, at a depth of 3,450 feet the ore bodies comprised four parallel lenticular veins known as the footwall, the main, the shaft and No. 1 veins. The footwall and shaft veins then carried somewhat better values in copper than the others; but in 1913, the average product of the mine contained slightly less than 2 per cent. of copper. At present, work is progressing at the bottom of the mine, upon two lenticular bodies of ore that average 2 per cent. in copper. The Maximum capacity of the mine equipment is about 200 tons per shift. The concentrating mill, which had a capacity of from about ten to twelve tons of mill feed per hour, and in which an Elmore oil concentrator was installed in 1913, was burned in August 1915. A new mill is in course of construction.

During 1909 to 1914, development work on a small scale, but more or less continuously, progressed at the Suffield mine on lot 3, range XI, Ascot, one of the properties of Mr. A. O. Norton. No ore was shipped during this period and upon the outbreak of war, work was suspended, although they were continuing to keep the water out of the mine. In 1910 and 1911, Mr. Norton also removed the water from the old workings of the Marrington mine on lot 6, range IX, of Ascot, but during this time only three tons of ore were sent to market.

In 1910, the Ascot mine had the water removed from it and some sampling was done for the East Canada Smelting Company, but no ore was shipped. In 1913, this mine was again reopened but soon was again permitted to fill with water.

In 1910, as a result of the interest aroused by the discovery of the Weedon mine, a lenticular deposit of pyrite was discovered on lot 8, range VI, S.W. of Stratford township, where in the years 1910 and 1911, an inclined shaft was sunk to a depth of 45 feet in the north-eastern end of the ore body. Four diamond drill holes were also put down and although several feet in thickness of pyrite were penetrated, the copper content of the ore was disappointing to those holding the property in lease at the time. In the summer and autumn of 1914, this property was leased by P. E. Beaudoin of Thetford Mines. The shaft was extended to a depth of 75 feet and in September, at a depth of about 50 feet, they were commencing to drift towards the southwest. About 1600 tons of pyrite carrying on the average from 45 to 48 per cent of sulphur and a mere trace of copper were shipped to the Grasselli Chemical Company's works at Hamilton, Ontario.

The Galt shaft of the old Ives mine, near Eastman, that had been closed since 1876, was reopened in May, 1911, by Messrs. Cromwell and Parker of Eastman. Since then prospecting work has been carried on more or less continuously. The shaft has been sunk from 100 to 180 feet and at this depth a drift extended for 72 feet to the southwest, along a zone of chlorite schists that for a width of four to five feet are traversed, parallel to their schistosity, by veins of chalcopyrite and quartz. Operations ceased a

*From report on Copper Deposits of Eastern Townships, Mines Branch, Quebec, 1915.

few months prior to the outbreak of the war. Six carloads, of about thirty tons each, have been shipped from the mine; five of these yielded an average copper content of nine and a half per cent., while one carload selected from a portion of one of the old dumps carried five per cent in copper.

In the summer of 1912, Mr. Pierre Tetrault, of Montreal, started to erect a concentrating mill at the Huntingdon mine (lot 8, range VIII, Bolton) with the aim of working over some of the old dumps on that property. The building was completed but the machinery has not been installed. In the spring and early summer of 1914, the water was pumped out of the old Nichols shaft down to about 275 feet. At a depth of 180 feet, some prospecting work was done where they found the schist impregnated with small amounts of chalcopyrite and pyrite, and traversed, parallel to the schistosity by narrow stringers of quartz carrying chalcopyrite Work was suspended on the property a month or more before the outbreak of the war. Mr. Tetrault has purchased the property from the Nichols' Copper Company.

In 1909, water was removed from the old shaft of the Lake Memphremagog mine (lot 28, range IX, Potton) and about 125 feet north of the open cut a new shaft was sunk to a depth of 80 or 90 feet.

In the fall of 1909, an Allis-Chalmers water jacketed furnace with a capacity of 80 tons per day, was erected at the old Acton mine, lot 32, range III, Acton by Mr. P. Tetrault of Montreal. The plan was to smelt portions of the old dumps at these mines, and carry on some custom work. About six hundred tons of cupriferous pyrrhotite were brought from the Lake Memphremagog mine; this pyrrhotite was roasted and then mixed with the copper bearing magnesian limestone of Acton. Fifteen hundred tons of ore, selected by hand-picking the old dumps at the Acton mine, are said to have carried about one and a half per cent. of copper. After a short run, operations were suspended and have not been renewed. It is certain that none of the dumps at the Acton mine will average a half a per cent in copper. At the Acton mine, black shales lie beneath an upper limestone and rest upon a series of massive limestone beds. The copper ore that was taken from this property in the early days came from the upper limestone and the uppermost portions of the shale in the vicinity of their contact with irregular dyke-like instrusions of a now highly altered diabase or closely allied rock. In 1913, in order to determine the possibility of mineralization of the lower limestone, a diamond drill hole was put down at what was considered to be the most favorable locality on the property: but no evidences of mineralization were found. This work was done under the direction of Prof. J. W. Bell of McGill University.

In addition to the above operations, some prospecting for copper has been done on other properties, but without discovering any deposits of economic value. During portions of the summer of 1914 prospecting work was being performed on lot 6, range VI, of Brompton, on lot 22, range V, of Stoke, on some lots in the vicinity of the deposit of pyrite at Stratford, and some diamond drilling was being done on lot 23, range III, Weedon, but no encouraging results were obtained.

Labor.—During the early days of prospecting and mining in the Eastern Townships, labor was cheap. Especially was this true of the period during and immediately after the Civil War (1861-65). At that time a considerable number of men, chiefly deserters from the army, and locally known as "skidaddlers," crossed the border into Canada. It was a good miner that during that period received $1.00 a day; $1.25 was a very exceptional wage, and many men considered themselves fortunate if they earned 75 to 80 cents a day.

At present wages are higher. At the Eustis, a miner eceives $1.75 a day. A large proportion of the men are on contract and some of them earn $3.00 or more a day. At Weedon, the average daily wage is $2.60. Much of the development work is done under contract at the following rates:—Drifts, 7 x 4, at $6.00 per foot; Raises, 6 x 10, at $4.50 per foot; Winzes, 10 x 5, at $12.50 per foot, and Shafts, 16 x 6, at $25.00 per foot. These prices cover all labor and supplies, except drill repairs, compressed air and drill steel. In raising and drifting, the company does the shovelling.

MINE-RESCUE AND FIRST AID TRAINING IN BRITISH COLUMBIA.

The larger coal mines of British Columbia are those situated on Vancouver Island and in the Crow's Nest district of Southeast Kootenay, respectively. Smaller fields are those of Nicola and Similkameen, which are about midway between the two larger fields. In all these coalfields instruction is given to miners and other mine-employees in both mine-rescue and first-aid methods. During 1915 it was manifest that first-aid work had taken a firm hold in the larger fields, for in both there were held first-aid demonstrations and competitions. Further, there was a gratifying increase in the total number of members of classes for instruction held under the auspices of the Canadian Branch of the St. John Ambulance Association, which association is the Ambulance Department of the Grand Priory of the Order of the Hospital of St. John of Jerusalem in England, and is engaged in doing work similar in many respects to that of the Red Cross Society in the United States.

On Vancouver Island first-aid instruction classes have been held at Cumberland (Comox colliery), Nanaimo, South Wellington, and Ladysmith (Extension colliery). There have also been several first-aid public demonstrations, in Comox district, at Nanaimo, and at Ladysmith. At the last-mentioned place there was held in November the first annual competition for the Frost-Cunningham Cup, donated by the mines surgeon, Dr. A. C. Frost, and J. H. Cunningham, superintendent of the Extension colliery. Four teams, each of five men, competed, and the winners were the members of team B, from No. 1 mine, Extension. Similarly, there have been demonstrations of the use of oxygen-breathing mine-rescue apparatus and the pulmotor.

The approximate number of men who attended the first lecture of the St. John Ambulance course of instruction in first-aid in 1915 was 700. While less than one-half of these presented themselves at the final examination at the conclusion of the course, it is satisfactory to note that fully 300 passed and obtained the St. John Ambulance Association's certificate of competency to render first-aid to the injured. These numbers include men connected with metalliferous mines as well. Classes were conducted at 20 different mines in 1915. The total number of mine-rescue proficiency certificates issued to date by the British Columbia Department of Mines is 244. Mine-rescue and first-aid railway cars are maintained by the Canadian Collieries (Dunsmuir) Limited, and the Western Fuel Co., on Vancouver Island. There are Government mine-rescue training stations at Nanaimo, Merritt (Nicola), and Fernie (Crow's Nest). Both Thos. Graham, chief inspector of mines, and Dudley Michel, instructor, are zealous in fostering first-aid and mine-rescue training work in the province.

THE METALLURGY OF CANADIAN COBALT ORES

I. METHOD OF TREATMENT AT THE COBALT PLANT OF THE CANADIAN COPPER CO.

By Ralph W. Bridges

The Cobalt plant of the Canadian Copper Company was situated at Copper Cliff, Ontario, about one half mile south of the large copper nickel smelter. The works were remodelled and designed to smelt and treat ores and concentrates from the Cobalt silver district. The plant was in operation from December, 1905, to February, 1913, during which time more than 40,000,000 ounces of silver, 2,200,000 pounds of cobalt, 1,500 000 pounds of nickel, and 4,500,000 pounds of pure arsenic were produced. Some idea of the richness of the ores treated can be obtained from Table 1. The low grade Crown Reserve ore included in this table was used as a flux.

Treatment:—If the ore was in large lumps it was crushed and then ground in a Krupp ball mill to pass 30 mesh. For sampling about 6% was cut out by a Snider sampler. Sampling was completed by coning and quartering. The first quartering divided the sample into four parts, which were worked down as two independent samples known as No. 1 and No. 2. These samples were reduced by quartering until the final quarters separated by a Jones sampler gave two samples of about 18 pounds, one of which was ground and the other held for reserve. The samples were ground to pass 100 mesh, or until nothing but silver scales remained which were weighed and assayed separately. The sampling work and moisture determination for the 8 cars of ore received in May, 1910, is shown in Table No. 2.

The ore was charged with suitable fluxes into 32" x 72" blast furnaces, having a capacity of 25 to 30 tons per 24 hours. Limestone from Michigan was used as a basic flux and low grade Crown Reserve ore was used as the acid flux.

The products of the blast furnaces were:—1. Flue dust and crude arsenic; 2. Slag; 3. Silver Bullion: and 4. Speiss.

The crude arsenic and flue dust from the blast furnaces and roasting furnaces were collected in suitable condensing chambers. The flue dust was recharged to the blast furnaces and the crude arsenic was sublimed from an arsenic refining furnace which made it ready for packing. Pure white arsenic assayed 99.98% arsenic oxide with about 0.03 ounces of silver per ton.

The slag from the blast furnaces during ore runs was rejected except when it was found to carry more than 10 ounces of silver per ton in which case it was used as revert to the blast furnaces. The slag produced while smelting speiss to remove the iron was all used as revert on ore runs because of its high silver and high cobalt content. Complete assays of the two slags were as follows:—

	Ore Slag	Speiss Slag
Silver	8.8 oz.	32.8 oz.
Arsenic	.13	.47
Cobalt	.44	13.97
Nickel	.29	1.28
Iron-oxide	11.63	28.54
Aluminum-oxide	14.15	9.75
Calcium-oxide	22.78	6.50
Magnesium-oxide	8.67	4.68
Silica	41.13	34.03
	99.35	99.22

The silver: About 75% of the Silver in the ore charged was obtained as buttons which were easily separated from the speiss and charged into an oil-fired cupelling furnace with a capacity of 30,000 ounces. The assay of this crude silver was as follows:—

Lot	Weight oz.	Assay	Fine Silver
668	16128.80	85.88	13851.41
669	14524.67	84.91	12332.90
670	15982.97	86.71	13858.83
673	15939.22	85.99	13706.14
674	14758.00	86.11	12708.11

After about 24 hours in the cupelling furnace the silver was ladelled out and cast into bars and shipped to the Balbach Smelting and Refining Company of Newark N.J. A few lots of this silver assayed as follows:—

Lot	Weight oz.	Assay	Fine Silver
637	46320.40	99.44	46065.17
645	37893.25	99.54	37721.97
649	34339.70	99.43	34147.05
652	50230.10	99.34	49900.59
659	52646.70	99.21	51238.68

The speiss was quite brittle as a rule and easily broken with a hammer. After being run through a crusher it was ground in the ball mill to pass 30 mesh, 20% of salt being added as the speiss was charged to the mill. This speiss, known in the smelter process as high iron speiss, was roasted in 8 Edwards reverberatory furnaces fitted with mechanical rabbles and having a capacity of 2400 pounds per 24 hours. The composition of high iron speiss is shown in Table No. 3.

The product of the roasting was a chloridized speiss which was transferred from the smelter to the hypo-leaching building. Here it was treated in a large agitation cylinder, first with cold water which dissolved out the undecomposed salt and the soluble salts of cobalt, nickel and copper. This water solution was decanted onto scrap iron to precipitate the copper and was then pumped to another tank where the cobalt and nickel were precipitated as hydrates by caustic soda. This precipitate was dried, calcined to oxides, ground and barrelled for shipment. The average assay of this material was:—Silver, 15.0 oz; Arsenic 0.3%; Cobalt 40.00 %; Nickel 3.00%. Nickel is lower than the usual proportion of nickel to cobalt for the reason that it is less easily converted to a soluble salt in the chloridizing roast.

After the wash with water the treatment of speiss is continued with four covers of sodium hyposulphite solution which takes all the silver chloride into solution and gives the "First Hypo Residue" which contains 20 to 30 oz. of silver. The silver was precipitated from the hypo-solution as silver sulphide which was collected in a filter-press, dried and mixed with sodium nitrate and carbonate. This mixture was roasted in an oil-fired furnace and then leached in hot water. The residue was a sponge-like mass of metallic silver which was charged to the silver refining furnace.

The "First Hypo Residue" resulting from the leaching process was returned to the smelter where it was mixed with quartz and run through the blast furnaces for the purpose of removing the iron. This was made necessary because of the contract under which the "Crude Cobalt Material" was sold, which required that the iron content be below 5%. This smelting operation resulted in a new green speiss called "Low Iron Speiss" of a composition shown in Table No. 4.

This speiss was milled with salt and roasted just the same as the "High Iron Speiss", and then washed with water and treated with hypo. The residue in this case was called "Second Hypo Residue". It was dried and

mixed with 20% sodium nitrate and 10% sodium carbonate and roasted in a reverberatory furnace. This converted the arsenic to sodium arsenic which was leached out with hot water. The dried residue was sold to refineries in Germany as "Crude Cobalt Material". the sampling and weighing being done by Ledoux and Co. of New York City.

The composition of a few lots shipped in 1912 is shown in Table No. 5.

Power for operating the smelter was supplied from the company's power plant at High Falls, Ontario, 14 miles distant from Copper Cliff. 200-300 horse power was required and 60 to 100 men were employed, working in 12 hour shifts.

A complete statement of the ore treated and the products of the cobalt plant while in operation is given in Table No. 6.

TABLE I.

Lot	Dry Weight	Co. %	Assay Ni. %	As. %	Ag. oz.	Metallic Content lbs. Cobalt	lbs. Nickel	lbs. Arsenic	Ounces Silver
				Buffalo Ore.					
399	48275	7.47	3.65	32.24	2135.38	3606	1762	15564	51542.73
403	45602	8.52	3.87	33.24	2169.77	3885	1765	15158	49472.93
408	45789	7 57	3.02	31.31	1823.34	3466	1383	14337	41744.46
416	44305	7.11	2.61	29.33	1680.11	3150	1156	13004	37218.64
				Nipissing Ore.					
407	63795	9.22	5.49	38.02	3535.99	5882	3502	24255	112789.24
422	64652	9.01	6.40	38.72	3022.60	5825	4138	25033	97708.37
426	62304	8.03	5.18	32.90	3852.70	5003	3227	20498	120193.31
437	64703	8.85	5.49	40.82	2209.53	5726	3552	26412	71481.61
				La Rose Ore.					
394	61839	8.79	7.94	37.33	1934.32	5436	4910	23084	59808.21
409	73040	9.04	6.69	39.65	1017.91	6603	4886	28960	37174.07
410	64967	9.16	8.16	40.30	1167.36	5951	5301	26182	37919.94
411	64680	9.30	6.69	39.12	1177.12	6015	4327	25303	38068.06
				Kerr Lake Ore.					
400	61379	10.74	3.85	44.56	3639.12	6592	2363	27350	111682.77
406	61487	6.87	3.08	24.51	4565.81	4224	1894	15070	140368.98
420	61560	10.65	3.56	40.00	4121.77	6556	2191	24624	126868.08
427	60876	7.33	2.30	29.77	3794.77	4440	1393	18033	114935.99
				Trethewey Ore.					
431	60878	10.00	1.77	48.58	1296.79	6088	1078	29575	39422.99
476	56387	10.26	2.30	41.54	3348.35	5785	1297	23423	94431.71
494	59843	9.67	2.31	49.75	1904.84	5787	1382	29772	56995.67
522	47520	9.86	1.91	46.60	1375.05	4685	908	22144	32671.19
				Temiskaming Ore.					
567	59262	5.89	1.34	21.80	3659.93	3491	794	12919	108358.49
576	59030	4.41	1.07	22.30	2742.82	2603	632	13164	80954.33
595	57987	3.70	2.41	15.00	3838.55	2146	1397	8698	111293.00
608	52384	3.47	2.43	14.30	3371.76	1818	1273	7491	88313.14
				Crown Reserve Ore—High Grade					
395	48624	6.42	4.04	21.16	5255 28	3122	1964	10287	127766.37
421	59776	8.40	5.45	28.73	4761.74	5021	3258	17174	142318.89
435	59666	8.75	5.61	32.42	4136.13	5221	3347	19344	123397.30
452	59047	5.84	4.86	19.29	4225.71	3448	2870	11390	124757.75
				Crown Reserve Ore—Low Grade.					
396	55347	0.36	0.46	1.15	250.10	199	255	636	6921.14
401	58621	0.32	0.32	1.15	144.15	188	188	674	4225.11
405	59769	0.39	0.50	1.05	141.75	233	299	628	4236.13
415	58754	0.30	0.33	0.75	121.00	176	194	441	3554.62

TABLE 2.

Date	Mine	Lot	Milled Weight	Sample Weight	Per ct. Sam.	Per ct. Water	Sample No. 1 Total wt. gr	Sample No. 1 Scales	Sample No. 1 Fines	Sample No. 2 Total wt. gr.	Sample No. 2 Scales	Sample No. 2 Fines
May 2	Buffalo...........	568	59713.5	3655.5	6.12	0.22	7003	27.67	6975.33	6442	42.71	6399.29
" 9	Temiskaming.....	569	6359.7	2129.5	3.35	3.83	6969	1.50	6967.50	6713	1.45	6711.55
" 10	Temiskaming.....	570	56915.5	2446.5	4.27	2.08	7719	17.23	7701.77	7441	25.83	7415.17
" 11	Buffalo...........	571	4787.5	3379.5	6.22	0.15	8226	36.11	8189.99	7984	44.20	7940.80
" 22	Crown Reserve....	572	6426.9	3114.	4.84	0.10	7695	200.65	7494.35	9569	192.26	9376.74
" 22	Buffalo...........	573	61180.5	3827.5	6.26	0.20	7438	60.47	7357.53	7509	46.25	7462 75
" 24	Millerette........	574	56430.5	3351.5	5.95	0.87	5004	....	......	5894	....	......
" 30	Crown Reserve.. .	575	63311.	3330.	5.26	0.12	8174	428.50	7745.50	8015	271.80	7733.20
	Average Sample........5.28%.											

TABLE NO. 3

High Iron Speiss

Lot	Dry Weight	Co. %	Ni. %	Assay As.%	Ag. oz.	Fe. %	Lb Cobalt	Lb Nickel	Lb. Arsenic	Ounces Silver
112	56656	25.13	15.61	34.10	1181.90	14.65	14238	8844	19320	33480.86
116	40144	24.24	8.53	30.25	1617.70	23.10	9731	3424	12144	32407.47
122	70008	25.38	16.23	32.70	1299.50	14.55	17768	11362	22893	45487.70
125	34654	23.28	10.92	31.50	1888.90	19.80	8067	3784	10916	32728.97
138	62783	22.78	12.26	30.40	1703.79	21 55	14302	87697	19086	53484.52
158	31077	24.48	19.60	31.45	1650.34	15.70	6677	6091	9774	25643.81
174	42014	29.86	14.48	28.85	1557.60	12.10	12545	6084	12121	32700.50
176	84284	22.25	21.57	30.25	1280.45	13.80	18753	18180	25496	53961.36
182	68885	25.59	20.70	33.65	1290.64	11.10	17628	14259	23180	44452.87
193	58854	29.57	13.44	30.20	1357.50	15.00	17403	7910	17774	39447.15

TABLE NO. 4.

Low Iron Speiss

Lot	Dry Weight	Co. %	Ni. %	Assay As. %	Ag. oz.	Fe. %	Lb. Cobalt	Lb. Nickel	Lb. Arsenic	Ounces Silver
118	12620	28.16	25.60	31.10	1617.90	3.90	3554	3238	3925	10208.95
128	18461	28.49	28.53	30.50	1451.65	3.60	5260	3267	5631	13399.46
157	58161	24.11	29.36	31.95	1552.50	4.75	14023	17076	18582	45147.48
163	9987	25.29	34.01	29.75	1184.75	2.00	2526	3397	2971	5916.05
165	9834	33.24	22.86	29.70	1210.00	4.30	3260	2248	2921	5949.57
167	18334	32.85	26.13	26.30	979.71	5.05	6033	4791	4822	8981.00
171	19992	31.21	25.51	29.20	1420.29	2.80	6240	5100	5838	14197.12
172	86705	29.31	30.73	28.10	1268.53	2.40	25413	26644	24364	54993.95
181	21095	28.60	31.01	27.65	1111.90	2.90	6033	6542	5833	11727.77
196	17573	28.10	25.35	30.55	1720.40	3.40	4938	4455	5369	15116.26

TABLE NO. 5

Crude Cobalt Material

Lot	Dry Weight	Co. %	Ni. %	Assay As. %	Ag. oz.	Fe. %	Lb. Cobalt	Lb. Nickel	Lb. Arsenic	Ounces Silver
19B	23714	31.00	31.66	1.10	36.60	......	7350	7508	261	433.97
20B	32783	30.92	31.63	1.10	29.70	......	10137	10369	361	486.83
21B	43086	31.38	30.40	1.08	28.00	......	13520	13098	465	603.20
22B	23691	31.92	28.68	1.10	25.90	......	7562	6795	261	306.80
23B	17182	31.72	28.60	1.15	24.00	......	5450	4914	198	206.18
24B	16759	31.47	29.18	1.10	34.80	......	5274	4890	184	291.61
25B	26292	31.91	28.97	0.98	31.80	......	8390	7617	258	418.04
26B	17382	28.64	25.11	1.21	48.70	......	4978	4365	210	423.25
27B	17629	28.45	24.43	1.13	50.40	......	5040	5015	199	444.25
28B	52363	29.84	29.10	1.30	36.40	......	15625	15238	681	953.01

TABLE NO. 6

Statement of Ore treated and product produced during operation of Cobalt plant.

Year	Pounds of Ore Treated	Ounces of Fine Silver Produced	Pounds of Cobalt	Pounds of Nickel	Pounds of White Arsenic
1906	1767692.5	1282692.78	9021	3987	....
1907	4560627.5	3829542.82	331151	138427	510622
1908	9857072.5	8551582.07	464171	268140	942827
1909	10651189.5	8779014.55	690737	463588	1248722
1910	9792571.0	8696624.87	346483	260756	843609
1911	6744108.0	6584102.46	238684	234323	680074
*1912	3266267.0	2798954.80	161412	169966	280486
	46642528.0	40522514.35	2241659	1539187	4500350

*9 Months

RELATION OF GOVERNMENTS TO MINING*

By Horace V. Winchell

(Continued from last issue)

Since the United States, although occupying less than six per cent. of the continental land area of the globe, and containing a little over six per cent. of its people, produces, roughly, over one-third of the world's minerals, we should expect to find among its citizens full appreciation of the importance of the mining industry, and on its statute books the best and wisest and most up-to-date provisions for the encouragement and perpetuation of this great industry.

The following statement is reproduced with slight changes from the report (No. 694) by the House Committee on Mines and Mining, Sixty-third Congress, second session, submitted May 20, 1914:

"That the mining industries of the country, and especially the metal-mining industries in our public-land States, are not keeping pace with the normal development of the country is clearly shown by the following data:

"In the population of the public-land States west of the Mississippi and Missouri Rivers there was an increase from 14,800,000 in 1900 to 19,600,000 in 1910, or 32 per cent.

"The agricultural crops of the public-land States had a valuation in 1900, of $921,000,000, and a valuation in 1910 of $1,950,000,000, an increase of 112 per cent.

"During similar periods the average annual valuation of all the mineral products in the public-land States increased from $287,000,000 during the period of 1901-1905 to an average annual valuation of $358,000,000 during the period from 1906-1910, an increase of less than 25 per cent.; whereas the production of the precious metals in the public-land States decreased from an annual average valuation of $136,000,000 during the earlier period (1901-1905) to an average valuation of $127,000,000 during the latter period (1906-1910), a decrease of nearly 7 per cent.

"No better illustration could be given of the contrast in the treatment of these two great national industries than the fact that in spite of this lagging behind in the mining industry during this 10 year period the National Government expended for the reclamation of agricultural lands in these public-land States not only all the money received from the sale of public lands for agricultural purposes, but also nearly $7,000,000 received from the sale of mineral lands in these States.

"The reduction in the nuumber of men employed in the different metal-mining industries in the public-land States tells even more clearly than do the figures of production the falling behind of the mining industry. The figures from one of these States may be taken as an example. The average number of men employed in the metal-mining and metallurgical industries in the State of Colorado for the 4-year period, 1900-1903, was 36,189; during the period from 1904-1907 the annual number of men employed was reduced to 34,364; and during the 4-year period from 1908-1911 the number of employees was further reduced to 22,560.

"Among the causes of this lagging of the mine development are the following:

"(a) The approaching exhaustion of many of the more easily discovered and richer ore deposits, and the fact that not enough other rich deposits are being discovered to supply ore to replace that now being extracted; (b) the absence of known methods of profitably working many low-grade ore deposits; (c) the wasteful methods now followed in some mining and metallurgical operations, which, although they may bring temporary profits to mine or furnace operators, are reducing the national wealth in a manner that can be remedied only by the discovery and use of more efficient methods.

"Of a number of our important mineral resources, we have for both the present and future needs of the Nation only an adequate supply. The utilization of certain of these resources, such as coal, oil, and natural gas, destroys them. Common prudence demands, therefore, that through the necessary researches the Nation should learn how to use this one supply of its mineral resources more wisely and more efficiently.

"The loss of life in the different branches of mining industry is a discredit to the Nation. It calls for more extended inquiries and researches on the part of the Federal Government, and a proper dissemination of the results obtained; it calls for more stringent police supervision or inspection by the State, and for more determined cooperative effort on the part of both the miners and the mine owners in the way of mining and enforcing safety regulations.

"The National Government should do its full duty in this matter without further delay. It should lead in a great movement for the practical conservation of life and resources.

"Congress is now appropriating as an aid to agricultural advancement about $28,000,000 per annum. These funds are being expended and the work authorized is being carried forward through a well-organized department with a Cabinet head and with nearly 14,000 employees.

"That these large expenditures have resulted in still larger benefits to the country there can be no doubt, and one of the evidences of the benefits is to be seen in the large increases in the aggregate value of the farm products of the country, which had an estimated value of less than $5,000,000,000 in 1898 and nearly $9,000,000,000 in 1912.

"The conditions underlying agricultural progress differ as to many details from those associated with mining, but the broad general principles of progress are the same, and the favorable response to the national aid for agriculture is itself an evidence of the favorable result that can be depended upon if similar aid is extended to mining. Furthermore, the less extended actual experience growing out of the more limited expenditures through the United States Geological Survey and the Bureau of Mines on behalf of the mining industry furnishes specific evidence of the larger benefits that may be expected to result from larger expenditures for mining investigations. Thus, under the Bureau of Mines, through a small expenditure, the saving in national wealth through stopping the waste of natural gas in one and one-half years has aggregated more than $15,000,000, which is several times the total cost of the maintenance of the Bureau of Mines from its beginning.

"The benefits that may be expected from more liberal aid to the mining industry will come (1) through a better safeguard of the health and lives of those engaged in mining and metallurgical operations; (2) through the lessening of the unnecessary waste in the mining and treatment of the various mineral products; (3) through increased efficiency in mining operations by the improvement of health and safety conditions; (4) through the development of more efficient and cheaper methods in the treatment of low-grade ore deposits, which are either not now worked at all or worked only in their richer parts or pockets.

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco. Cal., Sept. 20-25. 1915.

These benefits may come either through the discovery of new methods in connection with the researches of the Bureau itself or through its activity in stimulating researches by private parties.

"A brief statement of facts will indicate in a general way what the National Government is doing to aid the development of each of its two great basic industries and what in turn these two industries are contributing yearly to our national wealth and progress. Although the figures are not fully comparable in all respects, they will be found to be essentially correct.

"What these two basic industries do for the Nation:

Item.	Agriculture including forestry.	Mining and mineral industries.
Number of employees	13,000,000	2,300,000
Yearly value of products	$10,500,000,000	$4,600,000,000
What each worker in these industries contributes to the national wealth yearly	$800	$1,800
What each industry contributes to the freight tonnage of the country yearly, per cent.	22	60

"What the National Government is doing for each of these industries:

Yearly Appropriation.	Agriculture.	Mining.
For education—		
From direct appropriation	$2,500,000	......
From land grants	1,030,000	......
From Smith-Lever Act for demonstration educational work	480,000	......
For 52 experimental stations, one in each State and Territory	2,550,000	......
For general researches and other work to aid agriculture and mining	22,410,000	$1,967,000
Total	$27,970,000	$1,967,000
Per capita contribution from the people of the U. S. for advancement of these industries	$0.28	$0.02
Of this contribution the per capita expenditure for safeguarding the lives of 2,300,000 employees in the mining industry is about one-half of 1 per cent. per annum		.005

"Nothing can show the relative national neglect of the mining industry more clearly than does the above tabular statement; and this neglect is all the more difficult to understand in view of the hazards of that industry and the other conditions that should appeal to the humanitarian as well as to the commercial instincts of the American people. But another fact that tells the story with equal emphasis is that during the past 10 years, in addition to the large sums paid out of the National Treasury for the benefit of agriculture, as indicated above, and the payment towards the reclamation of agricultural lands in the Western States of all funds arising from the sale of public lands in those States, even the proceeds of the sale of the Nation's mineral resources in like manner have gone not to aid mining but to the reclamation of additional agricultural lands.

"Agriculture is much the larger of the two industries; it embraces a large number of persons, more widely distributed, and each acting as an independent agent. Its products, supplying the country with food, and clothing, bring this industry even closer to the lives of the people than does the mining industry, though the latter supplies them with the fuel that cooks their food, heats and lights their houses (which are built largely of mineral products), operates and supplies a large share of the materials and all the machinery of their factories, conducts and operates largely their facilities for transportation and communication, and supplies more than 60 per cent. of the total freight tonnage of the country. Indeed, the mining industry is in large measure the real basis of our modern civilization and national life.

"But, more than the above, there must be some special reasons why the mining industry has received relatively so little aid from the National Government, and these are to be found, no doubt, in certain misapprehensions concerning the industry. Mining is usually regarded as an industry comprising the operation of a few large, highly profitable properties, such as the old Comstock mines in Nevada, the Treadwell mine in Alaska, or the Homestake mine in South Dakota. It is usually considered to be an industry controlled by a few parties, the owners of the large properties mentioned, who would gladly avail themselves of an opportunity to unload on the National Government the cost of conducting those researches in which they are particularly interested. Therefore, it is usually considered as an industry that should be allowed, and even required, to take care of itself. These assumptions are far from correct.

"The facts of the situation are:

"(1) These large, highly profitable properties are few in number, and, so far as known, their owners have never joined in a request for Government appropriation to aid in the mining industry, nor have they been given any special consideration either in the establishment or in the plans of the U. S. Bureau of Mines. These mine owners have neither asked for assistance nor have they endeavored to unload upon the Government any investigations of their own. On the contrary, at the request of the Bureau of Mines, a number of them have expended considerable sums from their own funds for investigations that promise to be useful not only to them, but to other less important mining developments in which they are, and were in no way interested.

"(2) Although the number of large mines is small, there is a large number of small mines. The records show that in the country as a whole there are about 40,000 coal mines, metal mines, and quarries and about 170,000 oil wells that are operating on a smaller or larger scale. In addition there are many plants for treating ore by mechanical concentration, smelting, or other processes and various mineral-industry plants in different parts of the country. Few seem to appreciate the importance of helping those who hold these small properties to find methods of operation by which the properties can be worked at a profit instead of being helplessly transferred to a few large corporations which alone may have the funds for developing the processes that will make profitable operation possible.

"(3) The most urgent appeal for larger national aid to the mining industry comes from and on behalf of the 2,300,000 employees of the different branches of the industry, who are asking the aid of the Government in the development of safer and more healthful working conditions. The humanitarian appeal should be given precedence over calls for appropriations to advance commercial gains. It comes from employees working under hazardous conditions, a majority of whom are unfamiliar with our language, our laws, or our institutions. These men have been led to believe that the Government of the United States is interested in their welfare and has been planning to aid in bringing about safer and healthier conditions for them; but owing to long delays and slow progress in the Governments's work, they are now becoming discouraged in their belief that such plans would be realized.

"(4) Another important end to be sought through these larger contributions to the aid of the mining industry is helping the consumers or users of mineral products, who are distributed throughout every part of the country. Mineral products are becoming more and more indispensable to the domestic life of the people and to our manufacturers, as well as being the basis of transportation facilities and of the products to be transferred. Under normal conditions, as our mines become deeper and our mineral resources are depleted, not only the hazards of production but also the per capita cost of mineral products is increasing and one important purpose of the larger investigations proposed in behalf of the mining industry is to find how the cost to each consumer may be kept down to a minimum.

"Some special reasons why mining should receive larger national aid are enumerated below:

"(1) Agricultural products, if ordinary care is given to our soils, will be supplied continuously by annual crops. But as regards mineral resources the case is different. Our mines can produce only the one available supply; this one supply must meet the future as well as the present needs of the Nation; and a century's experience has clearly shown that our use of the more important of these resources, such as mineral fuels, precious and other metals, and potash and phosphate deposits, will increase much more rapidly than will our population.

"(2) Although certain of our mineral resources, such as the metals, are destroyed rather slowly in use. other essential resources, such as coal, oil, and natural gas, are consumed or destroyed beyond recovery.

"(3) In the utilization of certain of our mineral resources such as natural gas, petroleum, coal, zinc, and some of our other metals, there are large losses or wastes that are believed to be unnecessary, and it is a wise duty of the National Government to aid in the prevention of such wastes. These wastes now exceed $1,000,000 per day.

"(4) And more important than all the above in their appeals for the larger aid of the Federal Government are the hazards of the mining industry—the accidents that yearly result in such large losses of life and the unfavorable health conditions in many mines and metallurgical plants which affect adversely the vitality of employees. None of these conditions is encountered in agriculture, but they are in a peculiar way characteristic of the mining industry; and these conditions alone more than justify additional expenditures from the Federal Treasury."

Still another reason why federal aid should be extended to the mining industry is found in the fact that few countries are independent and self sufficing in their production of minerals and ores. This fact is brought prominently to the front at the present time, by the interruption to the world's commerce occasioned by war. In speaking of this situation, the Director of the United States Geological Survey uses the following language:

"I believe the mineral wealth of the United States is in largest measure the foundation of the marvelous growth of the last few decades. Industrial America! Think to what a degree the industries of America are based upon our ores and mineral fuels, or figure if you will the percentage of railroad tonnage that originates at the mine.

"Not only is our country a world-leader in the output of such essential minerals as coal, petroleum, copper, zinc, iron, lead, phosphate—and in three of these it exceeds all other countries put together—but as far as such things can be measured or estimated we are blest in the possession of the largest reserves of many of the more important of these minerals. No other country can in any sense compare with the United States in the degree of industrial independence afforded by the possession of these mineral resources. The raw material is at hand to enable us to win and maintain supremacy as a manufacturing nation.

"Yet, under this most-favored nation clause, the catalogue of our mineral resources is not the complete list of minerals essential to modern civilization; a few items are missing, others are present apparently only in insufficient quantities, and the quality or locality of the deposits of still other minerals may be unfavorable to present day utilization. Thus it happens that the nation is not wholly independent in its mineral industry. The list of what we lack is short. We are wholly dependent on other countries for only four principal items—tin and nickel, potash and nitrate. Among the minerals of which the United States has a deficient supply are manganese, platinum, gems and asbestos. Still other minerals it has been more profitable to buy abroad than at home, such as chrome ore, barytes, flint pebbles, magnesite, mica and graphite. * * *

If it is then important for the people and government of the United States to aid and encourage the development of its own mineral resources, how much more important should such efforts be for those nations which have not the generous provisions of nature in the shape of easily won mineral deposits. Nor is it alone the federal government which should evince an interest in the working of mines. Every state and province should do its share, and instead of looking upon mines as something to be taxed to the very limit or beyond, should feel that **it is of intimate and vital importance to every citizen of the state or province that its mines and quarries be worked to the highest stage of productivity of which they are capable.** Far greater than the value of the taxes paid into the state treasury is the benefit derived indirectly from great institutions for the production and working of minerals; and the operation of steady mines and metallurgical plants in a community is of incalculably greater importance than the derivation of direct revenues to enrich and often debauch the public treasury. For concrete examples of the truth of this statement look at Chile with its nitrate deposits paying millions yearly to the government and then turn to Sweden and observe its wise policy of encouragement of the development of its iron mines. The former country has not only not aided in the nitrate industry, but has done its best to turn it into cash for the government treasury, much to the disadvantage of public morals; the latter country has given its lands freely, has appropriated large sums for railroads and for other necessities to those who would develop an industry which would afford permanent employment to large numbers of laborers.

Full discussion of this subject would involve consideration of the bearing of mineral production on all lines of industry; it would necessitate a study of modern civilization and industrial development in all lands. For those who are already students of the subject, such elaboration is superfluous; to those who are not, it would be tiresome and unread. Enough has been said to indicate its importance. In conclusion, the following propositions may be taken as established beyond question:

1. From the dawn of civilization to the present time national standing has been dependent on and conditioned by mineral wealth and consumption.

2. Next to agriculture no industry so deserves the sympathy and aid of governments.

3. The attention of legislators, should not only be invited but compelled to the necessity for wise and sympathetic legislation in connection with the mining industry.

4. It is incumbent on every engineer and mining man, and indeed upon every citizen to insist that our mining laws shall be most carefully framed so as best to promote the interests of the mining industry, and hence of every industry throughout the entire length and breadth of the land.

According to General Manager James MacNaughton of the Calumet and Hecla Mining Co., the use of the Carr bit has resulted in an increased output per miner equivalent to his total output of a few years ago, thus not only decreasing costs but making available tremendous tonnages of low-grade ore that would not otherwise be commercial.

The decision of the British Admiralty to give Nova Scotia coal a thorough test will probably result in the removal of the prejudice in favor of Welsh coal and give a new outlet for the coal of Cape Breton.

CANADIAN SUPPLIES OF IRON AND STEEL IN RELATION TO MUNITIONS OF WAR*

By Thos. Cantley

The steel Industry in Canada is represented by plants in three of the Eastern Provinces: Nova Scotia, Quebec and Ontario. Those of the first and last mentioned Provinces are the most important, supplying over 99% of the total production.

Probably the first effort in iron smelting in Canada was made in the Province of Quebec. During the early decades of the last century we find that various small enterprises were started in all three Provinces, charcoal being used as fuel and local ores smelted. The amount of metal produced, however, was very small.

The Londonderry district in Nova Scotia was the first to assume commercial importance, and quite modern furnaces and plant were laid down about the middle of the last century. Iron was made here about the same date and a rolling mill was installed in 1860. It is of interest to note that the pig iron made at Londonderry had quite a good reputation, and was in demand. It is said that owing to its superior quality, the British War Office, upon the recommendation of Sir William Fairburn and others, used it for the manufacture of ordnance in these days, and imported it into England for the purpose. About 1875, there was further development in this district with important additions to plant; coke pig iron being then made for the first time in Canada in a commercial way. In a paper written on the iron and steel industry in 1885, Londonderry is referred to as the "site of the most important Iron Works in the Dominion." Up to 1887 it had produced over 200,000 tons of pig iron smelted from local ore; 42,000 tons of bar iron and forgings, and 40,000 tons of nail plate, wheels and castings. Operations at Londonderry have since been carried on intermittently, pig iron having last been made in 1908, and steel in 1912. Farther east at New Glasgow, the first steel was made on a commercial basis in 1883, when two 20-ton acid lined open hearth furnaces were put in operation. Imported pig was used. Four years later the basic open hearth process was adopted, thus making it possible to use local pig iron. Since this date all steel made in Nova Scotia has been exclusively basic open hearth. In the Pictou district the first iron was made in 1826, by the General Mining Association, then operating collieries at Albion Mines, when they smelted local ores using native flux with beehive coke made from Pictou coal. Owing to the refractory nature of the ore, the venture was not a success and operations were discontinued. In Cape Breton the first pig iron and steel was made in 1899, and from this date Cape Breton has been the most important steel district in the Province.

In 1737 the right of mining and smelting iron ore in the District of St. Maurice, near Three Rivers, was granted to a company by Louis XIV. From that date until a year or so ago mining, dredging, and smelting of bog ore has been carried on almost continuously in the district, on a small scale. Attempts to smelt iron on a commercial scale were made at Moise in 1867; at St. Urban in 1873, and at Hull in 1872 and 1887; but without commercial success. At Radnor and Drummondville, furnaces have been operated continuously from 1887 to 1912, using local ore, with locally made charcoal as fuel; producing on an average about 8000 tons per annum. At present there are no blast furnaces in operation and steel is only produced in small open hearth and electric furnaces, for making castings, or by the crucible method for special qualities; the tonnage involved being small.

One iron furnace was erected in Leeds County about 1800 and another at Normandale a few years later. These initial efforts proved failures, but in 1832 operations were resumed and continued until 1847. The Marmora furnace established in 1810 was operated unprofitably at intervals until 1875. A furnace was erected at Madoc, and operated for eight or nine years. Furnaces were also built at Houghton, in 1854, and at Burnt River, in Haliburton County. All these enterprises proved to be commercial failures, and in 1892 the Province of Ontario had not a single furnace in blast. Two years later in 1894, furnaces were put in operation at Hamilton by a company which is now incorporated with the Steel Company of Canada. These furnaces have been operated continuously since that time and the growth of the industry during the following decade was rapid.

Present Conditions

The industry as it exists to-day may be conveniently divided into two groups, the one in Nova Scotia, and the other in Ontario.

Nova Scotia.—In the province, the Nova Scotia Steel and Coal Company and the Dominion Steel Corporation operate under almost identical conditions. They use ore and coal from the same beds and generally are confronted with the same metallurgical problems. All the steel is made from Wabana (Newfoundland) ore, smelted with retort oven coke made locally from Cape Breton coal, while local flux is used. The blast furnaces are seven in number having a daily capacity of 1930 tons. There are eighteen open hearth furnaces including mixers, and two 15 ton Bessemer Converters.

Ontario: The industry here may be sub-divided into the Niagara Peninsula and the Lake Superior groups. All the important companies operate, however, under very similar metallurgical conditions.

In the Niagara peninsula, the following important companies are operating:

The Steel Company of Canada, with furnaces at Hamilton.

The Canada Iron Corporation, with furnaces at Midland.

The Canada Furnace Company, with furnaces at Port Colborne.

The Standard Iron Company, with furnaces at Deseronto.

In the district there are seven blast furnaces with daily capacity of 900 tons. The greater part of the ore and all of the fuel for these furnaces, is imported, although a couple of the smaller companies use a certain tonnage of local ores. Seven open hearth furnaces provide a steel making capacity of about 350,000 tons per year.

In the Lake Superior district, the following companies are located:—

The Algoma Steel Corporation, with furnaces at Sault Ste. Marie.

The Atikokan Iron Co., with furnaces at Port Arthur.

In this district there are four blast furnaces with a capacity of 1,050 tons per day, 5 steel furnaces and 2 Bessemer converters.

The Atikokan Iron Company has a furnace in the district with a capacity of 100 tons per day, which has been idle since 1911.

The ores smelted are partly native, from the Helen field and Magpie mines, but the greater part is imported from

*Read at a meeting held on November 10th, 1915, of the Montreal Metallurgical Association. This paper will also be presented and discussed at the Annual Meeting of the Canadian Mining Institute, March 1st, 1916.

the American Lake Superior ore field. The fuel used is, in part, locally made charcoal, but the greater part is coke, imported from Illinois or Pennsylvania. In 1910 a battery of 110 Koppers coke ovens was built at the Sault for the purpose of coking imported coal at the furnace, thus saving the breakage inevitably produced in the transportation of coke. In 1913 some 600,000 tons of coal was imported for this purpose and 419,000 tons of coke was made.

The consumption of materials used in smelting iron ores in Canada in 1914 was: ore etc, 1,358,184 tons, limestone 419,864 tons, coke 910,887 tons, charcoal 883,625 bushels.

The Nova Scotia industry is in the centre of Cape Breton coalfield. It supplies itself with coke and is thus self-supporting. The Ontario industry obtains all its fuel supply fron the United States, either in the form of coal or coke.

The following is a list of manufacturers of oven coke in Canada:

Company	No. and Type of Ovens	Location of Ovens
Intercol. Coal Mfg. Co., Montreal	36 Bee Hive.	Westville, N.S.
Londonderry I. and Mg. Co., Limited, Montreal	97 Bee Hive.	Londonderry, N.S.
Nova Scotia S. & C. Co., New Glasgow, N S	120 Bernard, 30 Bauer	Sydney Mines, N S
Dominion I & St Co, Sydney, N S	620 Otto Hoffman,	Sydney, N S
Atikokan Iron Co Limited, Port Arthur, Ont	100 Bee Hive	Port Arthur, Ont
The Algoma Steel Corp., Sault Ste Marie, Ont	110 Koppers,	Sault Ste Marie

There are in Canada, twenty-two blast furnaces, having a total theoretical capacity of 1,500,000 tons per year. These are in twelve separate plants and are owned by nine companies.

It is improbable that a greater tonnage than 1,350,000 can be obtained in 1915.

There are four steel plants in Canada containing thirty open-hearth furnaces and four Bessemer converters, and having a total capacity of 1,250,000 tons of steel a year: It is improbable that this amount can be exceeded during the coming year by more than 100,000 tons, and it should be borne in mind that 300,000 tons of this capacity is Bessemer steel which is not accepted in the manufacture of munitions. In addition there are eight or nine steel-casting plants, operating either small open-hearth furnaces or converters.

The production of steel ingots and castings in 1914 was: open hearth 549,716 tons, Bessemer 144,447 tons, other kinds 284 tons.

Electric Smelting.—In the above estimates we have not made any allowance for such additional tonnage as might be obtained by electric smelting. The tonnage of steel derived from this source in 1913 was under 5000 tons, not including the tonnage of ferro-alloys, which amounted to 8000 tons. The problem of electrically made steel is a large one. Melting scrap in a relatively inexpensive steel-furnace, where electric power is cheap, is very attractive. This no one doubts. The difficulties that may be encountered in securing any great tonnage in this way, while problematical, are bound to be enormous, and it is unlikely that our figures will have to be changed materially because of the tonnage derived in this way.

The following is a list of the companies making ferro-products or steel in the electric furnaces.

Name of company, address, location of plant, and products:—

The Electric Reduction Co., Buckingham, P.Q., Buckingham, ferro-phosphorous.

Electro Metals, Limited, Welland, Ont., Welland, Ont., ferro-silicon.

Electric Steel & Metals Co., Welland, Ont., Welland, Ont., steel castings.

Algoma Steel Corporation, Sault Ste. Marie, Sault Ste. Marie, ferro-silicon.

The Moffat Irving Steel Works, Limited, Toronto, Toronto, steel castings.

Tivani Electric Steel Co., Belleville, Ont., Belleville, steel castings.

Development of the Industry

The production of war munitions will doubtless be limited as much by the capacity of the blowing mills in this country as by the capacity for producing steel ingots.

In reviewing the statistics of the industry in reference to the present crisis it will be observed that its development has been slow. The first great impetus was given by the Iron and Steel Tariff of 1887 introduced by Sir Charles Tupper. It is due to his statesmanship that the conditions were established on which our present achievements rest. With the subsequent changes in import duties there was little advance in the industry until the second stage of development commenced at the close of the last century. This was brought about by the action of the Government in introducing a graduated system of bounties. This system resulted in large iron and steel enterprises in Nova Scotia and Ontario, culminating in 1913 in the production of 1,128,967 tons of pig iron and 1,168,993 tons of steel. It is a melancholy reflection that even in such a "banner" year. the iron and steel production of Canada was less than half our total requirements. During 1914 owing to the World-wide depression, the output declined considerably.

After the outbreak of hostilities the British War Office first looked to the United States for supplies of heavy ammunition. Thanks however to the initiative and energy displayed by the Canadian Minister of Militia, General Sir Sam Hughes, an invitation was shortly thereafter extended to Canada to help meet the requirements of the army in this respect. That it was possible to accept this invitation may be ascribed to the satisfactory condition of the iron and steel industries in Nova Scotia. Steel makers in that province were thus in a position to supply the steel and to make the forgings for shells. The Shell Committee co-ordinated this work and that of other manufacturers to produce the finished ammunition and in this way completed the first order for 200,000 shrapnel shells.

Between October, 1914 and June 10th, 1915, munition orders alone to the amount of over $160,000,000 were placed in Canada providing employment for thousands of workmen engaged not only in the iron and steel and allied industries but in other trades as well as to a large army of mechanics who would otherwise presumably have been without employment. As an example of the effect of the munition business in stimulating other than the metal industries it may be cited that over a million ammunition boxes for the making of which over ten million feet of lumber was used were supplied while a further twenty-five million feet of lumber has been made into cases to hold other munition exports.

During the first nine months of 1915 there was shipped to Great Britain from Canadian ports more than 4,229,000 shells about twenty-five per cent of which was fixed ammunition. Incidentally it may be of interest to mention that Nova Scotia Steel Co., the first of the Canadian steel companies undertaking to supply shell steel and shrapnel forgings, made at the company's New Glasgow plant during the twelve months ended October 31st last, a total

of 2,145,525 shell forgings, over twenty per cent of which were of the largest size for high explosive shells yet produced in Canada.

During the past spring and summer Canadian exports increased in volume at a rate never before experienced in the history of the country. This condition of affairs is largely attributable to the establishment of the business in munitions. Canada had built up a steel industry. In addition to what has been already accomplished the Dominion will probably during the next fifteen months, export to Great Britain munitions aggregating in value not less than two hundred millions of dollars—possibly three hundred millions of dollars—fully eighty per cent of which will be wholly the product of Canadian labor.

Whether the value of these exports will reach the higher figure mentioned depends merely on whether a sufficient supply of steel either from Canadian furnaces or elsewhere is obtainable. If the steel can be secured the engineering shops of the country can without doubt undertake the assembling and finishing of shells to the value of more than $300,000,000.

The largest production of steel ingots in Canada in any year was in 1913, when a total output of 1,048,538 tons was recorded. In 1914 this declined to 775,000 tons. Since the close of 1913, the steel producing capacity of the Canadian plants has been only slightly increased, and consequently, it is doubtful if the production this year will exceed at the utmost 1,250,000 tons.

Meanwhile in the United States, an extraordinary situation at present obtains. Never in the history of the steel industry of that country has the demand for steel been so great; and buyers for steel of every description are experiencing increasing difficulty in securing supplies. During the month of October last, the United States production o pig iron exceeded 3,000,000 tons, a monthly output never previously atta ned. It was greater in fact than the September record by over 95,000 tons, and was almost double the production made during October,1914. The amazing consideration is that while the United States to-day is producing pig iron at the unprecedented rate of 37,500,000 tons a year, prices are advancing daily. The advance in price during the first week in November was 50 cents a ton on coke iron and $1.00 a ton on charcoal iron; while during the year basic iron has advanced from $12.50 to $15.80 a ton. The demand for and the increase in price of steel is even greater than in the case of pig iron. Indeed the situation is unique as regards the price of finished steel, and at present it is difficult to find a seller who can make deliveries. Eastern and Western mills are alike congested with business, and very few indeed have any open capacity.

Plate mills are fully occupied with car, locomotive and ship-building work. The railways, which were almost entirely absent from the market for many months past, have recently given orders for large quantities of rails; while about 300,000 tons it is understood, have been booked for export within the coming two months to Russia. During October, the American railways bought more than 27,000 cars, and probably more than 10,000 have been booked for export to the Russian Government. As regards steel plates, the increase in price is even greater, while it has failed to discourage demand in the least; in fact in many cases, price is no longer a consideration, but rather to find a mill that will guarantee deliveries. While the situation as regards structural steel is grave, it is in forging billets that the situation is most acute. Steel bars in November 1914 sold at Pittsburg at $1.10. In November 1915,the price was $1.50 or a 36 per cent advance. In forging billets the difference was much greater, the figures being $25 and $42 respectively; or an advance of sixty-eight per cent. Indeed high carbon steel sold in large quantities at previously unheard of prices. Even during the closing days of October orders aggregating more than 60,000 tons of high carbon forgings billets were reported as having sold as high as $56.00 per ton, Pittsburg. Further it is stated that the Entente requirements, now becoming insistent for high carbon shell steel, alone represent the enormous aggregate of 20,000,000 tons.

It is therefore clearly evident that Canada and the United States will, during the coming year, face a steel famine unprecedented in the history of this continent. The outcome will be as interesting as it will be far-reaching. It will probably reduce very largely some of the profits so easily shown on paper as capable of being earned by munition plants yet unbuilt, and which must necessarily be dependent for a supply of raw material on producers of iron and steel.

It will be seen from the above statements that a strong and evenly balanced iron and steel industry constitutes an important national asset.

COBALT SHIPMENTS.

Cobalt, Jan. 8.—Ore shipments for the week were considerably over double that of the preceding week. Ten shippers sent out fourteen cars, five of which went to American smelters. Included in the list was a copper shipment sent out by the Rand Syndicate to Chrome, New Jersey. Temiskaming had two cars and was second on the list, Nipissing taking the lead. There were no bullion shipments for the week ending last night.

Silver ore shipments for the week ending yesterday were as follows:

Mine.	Pounds.
Coniagas	121,525
Penn. Canadian	100.089
Buffalo	62,255
Nipissing	131,168
Peterson Lake	66,000
Dominion Reduction	88,000
Mining Corporation—	
Townsite City	71,234
Cobalt Lake	65,713
Beaver Mine	64,763
Temiskaming	127,212
Total Silver	897,959
Copper—	
Rand Syndicate	49,912

A press despatch from Seward, Alaska, gave the information that on December 29th the steamer Northwestern sailed from that port for Seattle, Washington, having on board $550,000 worth of gold bullion brought to Seward by dog-teams from Iditarod, and $50.000 worth of copper ore. It was stated, further, that the Northwestern was to take from places on Prince William sound about $100,000 worth of copper ore, also for Puget sound, where it would most likely be smelted at the Tacoma smeltery.

At Vancouver, B.C., on December 28th two writs were issued at the instance of Zera Strong against A. N. C. Treadgold, of London, in connection with the sale and purchase of placer gold claims in Yukon Territory. One of the writs is for a balance of $21,300, balance of principal and interest alleged to be due the plaintiff on purchase price of his claims, and the other is for 10,000 shares in the Granville Mining Co., stated to have been given to the defendant for sale on plaintiff's account.

THE MARKET FOR MOLYBDENITE

The Director of the Imperial Institute of the United Kingdom, the Colonies and India, South Kensington, London, S.W., under date of 17th December, 1915, says in a letter to Mr. T. W. Gibson, Deputy Minister of Mines of Ontario:

With reference to the disposal of the molybdenite which is becoming available in Canada, I may say that the British Government has recently taken action with a view to securing supplies of molybdenum ores for munition purposes, and the market for the ores in this country is now under Government control. An official arrangement has been made with regard to Australian supplies and I therefore consulted the Ministry of Munitions as to the procedure which should be adopted with regard to Canada.

I am informed by the Ministry that it has been decided to leave the question of Canadian supplies of molybdenite in the hands of the Dominion Shell Committee at Ottawa (now I believe merged in the new Imperial Munitions Board), who have been notified that the British Government will purchase up to 50 tons of molybdenite ore. The arrangements have been left entirely in the hands of this committee and it is therefore desired that all communications on the subject of Canadian supplies should be addressed to the committee or to the new Munitions Board.

I suggest that this information should be made public in Canada, if this has not been done already, as the Imperial Institute is receiving a considerable number of enquiries from that country with reference to the disposal of molybdenite ores or properties, and is of course still ready to be of any service on this side that may be required.

With reference to the disposal of molybdenite properties, the following persons and firms have applied to the Imperial Institute for information regarding such properties with a view to purchase: Mr. R. Woodburn Kirby, 26 College Street, London, EC.; The Osram Lamp Works, Ltd., Brook Green, Hammersmith, London, W.; L. LePersonne and Co. (Metal Department), 99 Cannon Street, London, E.C.; Mr. J. C. Stead, 57 Chancery Lane, London, W.C.

Enquirers in Canada might be given these names, but it must be understood that the Imperial Institute cannot assume any responsibility regarding firms and persons mentioned.

The samples of molybdenite concentrates prepared at Orillia by the Orillia Molybdenum Co., which you forwarded, are too small for complete investigation, but the following results of their mineralogical examination may be given. No. 1 consists of coarse flakes and is apparently clean molybdenite. Nos. 2 and 3 consist of smaller flakes (No. 3 being the finest) and contain mica, but the molybdenite largely preponderates in both samples. No. 2 was found to contain about 6½ per cent. of biotite mica (including a little quartz) and a little pyrite. No. 3 contains about 12½ per cent. biotite mica (including a little quartz) and, like No. 2, also included a little pyrite. It would therefore appear that the percentages of molybdenite present in these concentrates are not below the figures which you quoted.

The Ministry of Munitions has asked for information as to the quality of the samples and I am accordingly transmitting these particulars to them.

PERSONAL AND GENERAL

Mr. Wm. Alderson, superintendent of the Hollinger gold mine, has resigned.

Mr. Chas. Fergie, of Montreal, has been nominated as vice-president of the Canadian Mining Institute.

Mr. J. A. Dresser, of Montreal, has been nominated as a councillor of the Canadian Mining Institute.

Mr. Duncan Chisholm, of Toronto, has taken an option on the Jamieson claims in Rodd township.

Mr. M. W. Summerhayes has been nominated as a councillor for the Canadian Mining Institute.

Mr. O. E. Le Roy, chief geologist of the Canadian Geological Survey, has obtained a commission in the Seaforth Highlanders.

Mr. E. F. Cartwright, of Alden, N.Y., and Mr. R. W. Cartwright, of Ridgeway, Pa., are at Porcupine.

Mr. H. C. Anchor is in charge of the Dome Extension property at Porcupine, where exploration has been resumed.

Dr. W. G. Miller and Mr. Cyril W. Knight, of Toronto, attended the meeting of the Geological Society of America at Washington, D.C.

Dr. W. G. Miller and Mr. T. W. Gibson, of the Ontario Nickel Commission, are en route to Cuba.

Mr. Geo. T. Holloway, chairman of the Ontario Nickel Commission, is in England.

Mr. J. B. Tyrrell expects to leave shortly for England.

Mr. Geo. B. Church has returned to New York from Juneau, Alaska.

Mr. G. G. S. Lindsey expects to return to Canada in February.

Drs. McCracken, of Worthington, Couts, of Garson Mine, and Freeman, of Levack, of the Mond Nickel Co.'s medical staff, have enlisted for service overseas in the Army Medical Corps.

Brigadier-General John Carson, honored by his King in being created a Civil Commander of the Bath, is a striking example of the "self-made" man. It is only a few years ago that he was an insurance agent—but a thoroughly aggressive one. His energy and capabilities have placed him where he is to-day. The Brigadier-General is best known as the president of Crown Reserve Mining Co. It was Crown Reserve that gave him his present wealth.

M. Beatty & Sons, Ltd., Welland, have received an order from the Confederation Construction Co., contractors on section 3, Welland Ship Canal, for six electric hoists—for a concrete handling plant.

According to our Newfoundland correspondent this winter promises to be the best mining season that Newfoundland has ever enjoyed. The great iron deposits are to be worked all through the winter on an unprecedented scale. For the first time the five iron mines of the Dominion Iron and Steel Company are all being worked.

In its excellent annual review number issued on January 8, our esteemed contemporary, the Engineering and Mining Journal, of New York, estimates Canada's gold production in 1915 at $15,875,000 as compared with $15,925,044 in 1914. As a matter of fact Canada's gold production in 1915, instead of being smaller than in 1914 was nearly $3,000,000 greater.

SPECIAL CORRESPONDENCE

PORCUPINE AND KIRKLAND LAKE

Dome.—The December returns for the Dome Mining Company, now officially made, complete the record for the year. The total for the twelve months of 1915 show that the Dome produced $1,468,272. The average grade for the year was $4.56 per ton. The recent grade during the last six months has considerably exceeded this, since ore has been mined from the new and higher grade orebody. It is a fact, however, of importance, that 70 to 71 per cent. of the total ore is still coming from the original Dome or Glory Hole. The mill and mine will not be in good shape to handle this new ore for a month or six weeks yet. After that it is probable that the grade will be slightly increased, though there is not any intention to use the higher grade of the ore to force production. Tonnage treated during the year was 317,873. The last month's crushing of 30,120 tons was considerably more than 21,000 tons higher than of any previous monthly period. Bullion produced had not a corresponding increase, it being less than $1,000 higher than in November. The production for the month of December was 30,120 tons milled, value $160,950.70, with an average per ton of $5.34.

The production this month will show a considerable increase as the new Hardinge mill has been installed. The manufacturers fully expect that the ball mill will treat over 300 tons a day, but it is not to be anticipated that it will reach this maximum until some months of trial. The ball mill is of the eight foot, thirty-inch type and has been installed alongside the stamps and will do almost the same work. Two more pachuca tanks have also been installed. These are nine feet in diameter instead of eight feet. The two extra sand tanks and Dorr Thickeners will be of the same size. It is the intention of the management to install more ball mills as the opportunity occurs and it is desired to still further raise tonnage. At the Dome and in the Porcupine Camp generally it is believed that the ball mills will handle Porcupine ore under certain conditions better than the stamps, therefore, not only will ball mills be introduced to take care of further tonnage, but as stamps are worn out they will be replaced by ball mills.

Excellent progress is being made with the new central shaft at the Dome. Raises have now been holed through from the 600 foot to the surface and it is confidently expected that the new shaft will be completed and ready for use before the date it was determined, namely, the first of March. Cross cuts from the present working shaft to the new central shaft have been opened up and a considerable body of ore indicated by diamond drilling, but not before actually put in sight. This orebody is 40 feet wide and 200 feet long as at present determined.

Hollinger.—The Hollinger production for the 12th period of the big mine in 1915 easily broke all records. The production of $210,558 gross profits was not less than $25,790 more than at any previous period of the Hollinger history. This very considerable increase was due to the fact that over 1,000 tons more ore was crushed and also that the grade was better by 65 cents a ton. Both mining and milling costs were higher, but general costs were lower, so that the total costs for the period ending December 2nd were $3,522, in which we include 0.882 milling costs per ton and 1.982 mining costs per ton. It is to be remarked that the total costs for the past seven periods average $3,574 a ton, whereas the average grade was $9,645 a ton, leaving a profit per ton of $6,701.

In the long cross-cut which is being run to connect the new central shaft with the shaft which is being sunk on the Gillies claim near the Vipond boundary, two promising veins have already been cut. As these veins were not previously on any Hollinger charts they give promise of yielding an increase in ore reserves above any estimate. The completion of the cross-cut will take much time as it is a distance of 2,500 feet between points and only one drill is operating in the face.

The McIntyre-Extension shaft has now reached the thousand-foot level, a depth only attained by one other company in the Porcupine. From it, it is proposed to carry on all development on the McIntyre group which now includes the McIntyre, McIntyre-Extension, and McIntyre-Jupiter. The next development will be to commence the cross-cut to the No. 5 shaft where work on the lower levels is already congested. It is a distance of about 800 feet, so that it will be some time before it is completed. To the north of No. 5 shaft drifting on the 500 and 600 ft. levels is confirming the diamond drill work done here early in the year. The orebody where first encountered was 20 ft. wide from the foot wall. It ran about thirty dollars to the ton for about ten feet, but the quartz in the remainder of the orebody ran quite low. Intrusions of schist are now beginning to appear in this quartz and as they do so, the values grow. The vein is also opened up on the 600 ft. level. The building to house the additional machinery to be installed at the McIntyre mill has been completed some time, also the Dorr machinery for the cyanide mill has arrived, but delivery of the tube mills and ball mills is not satisfactory and it may be some time before the addition to the mill is running, in consequence of this delay.

Jupiter.—Progress in making ready the Jupiter to be a producing mine once more is marked. In B shaft a raise has been holed through from the 300 to 200 ft. level. The mine is also being re-surveyed and there is no doubt that mining should be well under way by the first of February.

Dome Lake.—There is some interest among mill men in the new process of cyanidation to be used at the Dome Lake mill. Without going into details it might be stated that a Detroit company proposes to treat the tails from the present mill in a large rotary drum. They claim for this process that it will make good extraction in four hours instead of 17 to 18 hours, and that the costs will be low. The Dome Lake mill is not making any payment on machinery or under any obligation in any way until it has been shown to be successful. The company guarantees to obtain a 95 per cent. extraction, otherwise they will not claim anything for their installation.

Burns Claims.—The little two-stamp mill which has been erected on the Tommie Burns claims in Shaw is now running. The same syndicate of working miners which made a success of their lease on the Gold Reef formed a company known as the Excelsior Mining Company. After the expiry of their lease on the Gold Reef they took up the lease on the Burns claims in Shaw and have now been working them for some time. They are sinking two shafts, one on a vein of quartz in which there is remarkable values in gold. This vein

is from one to two inches wide and as there is no sulphide ore in it, a good extraction should be made from the plate. The other shaft is being sunk on a big sulphide vein. There is a good deal of free gold in this vein, so that the operators hope to save quite a little from running this ore through the mill.

Jamieson.—Mr. Duncan Chisholm for his New York connections has taken over the Jamieson claims in Robb Township. These claims have been sampled more than once, but interest previously was not as keen in Porcupine prospects as to-day. The gold is found in quartz stringers over a quartz porphyry dyke about 200 feet wide. Mr. Chisholm has sent down a gang of eight or ten men and camps are being erected and surface work commenced, at once. The properties are about twenty miles from Timmins, near Kamiskotia Lake.

The Dome Extension Mining Company has overhauled its plant and commenced de-watering the mine. It is probable that one of the first operations undertaken will be diamond drilling near the Dome boundary. Recent development on the Dome has led to the belief that one of the Dome orebodies dips into the Dome-Extension at a depth of between 1,000 and 1,200 feet. Diamond drilling will be undertaken to ascertain if this is true, and to see if the orebody holds its value on the Extension side of the line.

New Companies at Porcupine.—There are prospects of several other companies starting up work in the Porcupine district in a very short time. Mr. A. M. Bilsky has recently been looking over the Apex for a Montreal company, with a view to seeing if it is desirable to open up the old property. It is understood that the American Goldfields will soon resume work on the claims in Tisdale. There are also reports that the Moneta Mining Company contemplate doing something on their properties adjoining the Miller Middleton. The Tisdale Mining Company is sinking a shaft near the Dome Lake line. It is certain that the West Dome contemplate opening up the old workings, but there is nothing definite as to when the actual de-watering will commence.

Demand for Prospects.—There is very great demand for Porcupine prospects and there is every indication that not only the producing properties in the centre of the camp will be busy this spring, but that many good prospects that have lain idle for years will be worked again.

COBALT, GOWGANDA AND SOUTH LORRAIN

The Nipissing had another unusually favorable month in regard to the discovery of new ore in December. The important discovery was on vein 490, on which a winze is being sunk on the fourth level. Until a depth of 75 ft. had been reached the vein was from three to eight inches in width and generally assayed low in silver values, running from 5 to 144 oz. At a depth of 75 ft. the vein was eight inches wide, very heavy in niccolite and a few feet assayed as high as seven or eight thousand oz. The next few feet found the vein faulted and low grade again, but geological conditions lead to the belief that it will hold more high grade ore.

At 80 shaft good ore was met with in the faulted extension of one of the branch veins at the 200 ft. level. about 50 ft. of an incline was driven on a vein averaging 2 in. in width and assayed 2,000 oz. Favorable results also continue in drifting on vein 102 at 96 tunnel. Ninety ft. of drifting has been done to date, in which distance the vein assays better than 4,000 oz. over an average width of one and a half inches. Further development has been started with a veiw to finding the top of the ore shoot.

To make a base for operations to cut the Cobalt Lake fault vein surface buildings have been completed at 81 shaft. Sinking is now being prosecuted and will be carried on to a depth of 480 ft.

Actual production from the Nipissing for the month constituted a low record for the company for some years. The estimated value of the production during December was only $112,907, whereas no previous production has fallen below $164,846. On the other hand bullion shipped from the mine was higher, reaching $379,642. But this was mostly customs ore, the Nipissing now being a very large purchaser of silver ore from other mining companies in the camp. The Nipissing stopes are now fuller than they have ever been in the history of the company and the discoveries of new orebodies at the Meyer shaft and under Cobalt Lake makes the future prospects brighter than for a long time.

McKinley.—While it is impossible to estimate ore reserves for more than six months at either the McKinley-Darragh or the Savage mines there is no doubt in the minds of those well acquainted with the old property that it will again be capable of surprises in 1916. The last annual report showed ore reserves of 55,176 tons and 12,835 tons for the Savage or a total of 68,011 tons. There has been milled during the year just past approximately 60,000 tons, so that there should be in sight less than 10,000 tons. As a matter of fact the tonnage is as great as at the beginning of 1915, though the silver content per ton is probably lower. No new orebodies have been found, but old orebodies have been discovered on lower levels and what was supposed to be the wall of the orebody has been discovered to be nothing more than a small barren block of ground on the other side of which there was good milling ore.

The blind vein at the 250 ft. level has been conducive of the most surprises. Estimates at the beginning of the year only gave ten feet below the 200 ft. level as likely to yield ore, but there is to-day a stope 35 ft. wide at the 250 ft. level on this vein. The Lake vein has also proved to be much less near exhaustion than was imagined and No. 20 on the 200 ft. level has yielded remarkably.

It was believed last year that the Savage would be worked out in 1915. Here again there have been no definitely new discoveries, but the old orebodies are being found to be much more extensive than any estimates gave them credit for. Some rich ore is now being taken out of a wide calcite vein in the old original shaft on the property. It was barren in the face as left for years, but a few shots discovered some rich high grade.

Chambers-Ferland still continues to make marked progress in the work at their shaft to the north of the town. All recent development has been from a winze sunk from the 300 ft. level., It was sunk on a strong vein of niccolite and smaltite carrying low silver values. This vein dipped out of the winze and it was necessary to cross-cut some 15 ft. before picking it up at a depth of 426 ft. It is here two to three and a half inches wide of ore that will run up to 3,000 oz. in silver. At the bottom of the winze there is an inch to an inch and a half of argentite ore. Eleven feet from the bottom of the winze there is an inch of smaltite ore running low in silver and 40 ft. away another inch vein

of high grade. A drift has now been pushed north-east on the main vein for about 40 ft. The experience in the Nipissing ground adjoining makes it most probable that there will be a big tonnage of mill ore between these various veins. An ore house is being built in which a sorting plant will be installed. Ore is already being sacked.

The Ophir Cobalt has been pumped out by the company and actual mining will soon commence under the direction of Mr. B. Neilly. The Silver Cliff has also been pumped out and sampled by the United States Smelting and Refining Co. and there are quite a number of other silver prospects being examined with a view to re-opening. The Genesee Mining Company operating the United States Cobalt prospect just north of the Hudson Bay, will start work again next week, Mr. Steenman, who is in charge of operations, returning from Rochester. The Coniagas Mining Company has purchased the Agaunico prospect on the shore of Lake Timiskaming near Haileybury and is now pumping it out before sampling.

The Flotation Process for the treatment of tailings in Cobalt has obtained a foothold in the camp. Experiments with the Callow process have been in progress for some time at the Buffalo mill and a small plant has been running on tailings for two months. The results are reported to be so satisfactory that several other companies in the camp are experimenting. In an annex to their low grade mill the Nipissing is installing a four unit plant for experimental purposes. It should be running very shortly. The McKinley-Darragh also has under consideration the installation of the process in connection with their water concentration mill and a contract has been drawn up for that purpose. Other companies have either tried or are now trying the process and it seems likely to meet with a fair measure of success.

NEWFOUNDLAND

Iron.—This winter promises to be the best mining season that Newfoundland ever enjoyed. The iron mines of the Dominion Iron and Steel Co., and of the Nova Scotia Steel Co., are to be worked all through the winter on an unprecedented scale. Till the beginning of the New Year, the activities that prevailed at the mines on Bell Island have during the winter been in a large measure preparatory to the great opening up that is now taking place.

With the Dominion Iron and Steel Co. mines Nos. 1, 2, 3, 4 and 5 are now being worked. This is the first time in the history of this company that these five mines have been worked together. Dominion No. 4 is practically a new mine, and little or no mineral has as yet been mined from it. The ore, however, has been thoroughly tested on this territory, and the quantity in which it is present as well as the quality has sufficiently warranted the grand scale on which this mine is now being opened.

Dominon No. 3, which has not been worked for eight years, and which was entirely filled with water, had to be pumped dry. This mine has a depth of roughly three thousand five hundred feet. It took one month to pump this mine, which meant an expenditure of perhaps $15,-000. In addition to this the several surface mines of the company are being all worked, so that the daily output surpasses anything ever attained before.

With the Nova Scotia Steel Co. work is also being resumed on something approaching the old scale of operations. 1915 has been no doubt the "off" year in the history of the Nova Scotia Co. in Newfoundland. For the year the company shipped 188,260 tons of ore, and employed 450 workmen. Of the amount shipped 64,000 tons had been mined the year previous.

Since the opening of the New Year, however, there is every indication, judging from the increased activity displayed, that during 1916 the output from the mines of this company will approach 500,000 tons of iron ore.

Copper.—The Cape Copper mine at Tilt Cove, Notre Dame Bay is now working at a fairly good clip. More than one hundred men are employed at this mine at the present time. The last shipment of ore from this mine for this season has just left the coast. The shipment was taken by the S. S. Newfoundland, and is consigned to New York.

At the Baie Verte copper mine work is now progressing favorably; operations are to be continued through the winter. The stock pile that has already grown to a considerable size will be shipped away to English and American markets as soon as navigation opens in the spring.

The limestone quarries owned and operated by the Dominion Iron and Steel Co. for the past number of years in connection with the smelting of its iron ore has been completely closed down. All the employees have therefore left the limestone district, and found employment elsewhere.

The quarries, we understand, are to remain inoperative till the opening of the spring.

Electric Smelter.—Work is about to begin on a new electric smelter, to be established at St. John's, near the plant of the Reid Newfoundland Co. Mr. W. A. Mackay who is promoting the scheme has received from the municipal authorities at St. John's the necessary permit to the construction of such a plant. The electric power for the smelter will be secured from the Reid Company's power station at Petty Harbor.

Building Slate.—As there is likely to be a good de mand for building slate after the war, for some time past much negotiation has been made for the purchase of some of the slate quarries of this country. The slate quarries of Newfoundland are large and of a very fine quality, and at intervals have been worked for years.

The Government Geological Survey of Newfoundland made by James P. Howley, F.G.S., in 1909, has this to say of the slate quarries of the country: "The slate o this country is of a superior quality, and has been pro nounced equal to that of Wales by those competent t judge. It fetches in the English markets the highes price of any imported slate. It is an abundant mate rial and is found in large deposits on the eastern an western sides of the island. Most of this slate is of dark purple color, but some of it is reddish, and als some of an unfading pea-green color. It is said to b the best slate in America."

During the short intervals that these quarries hav been worked to date 153,702 squares of roofing slat have been manufactured at the quarries.

Thomas L. Wilson, the promoter of the Newfoun land Products Co., died in New York Dec. 23rd. Mr Wilson, who has been best known as "Carbide" Wilson came to Newfoundland last year and was instrumenta in putting through the House of Assembly one of th most gigantic schemes for the development of some o Newfoundland's mineral resources ever attempted.

This scheme was for the manufacture of the fertilize ammonium sulphate. The construction of this pla was to involve an expenditure of twenty-one millio

dollars. At the time of his death Mr. Wilson was in New York in connection with the financing of this corporation, and had met with excellent success.

A sketch of this scheme and what it entails was published in the number of the Canadian Mining Journal dated Dec. 1st, 1915.

As the work of construction of the plant of the corporation has been begun and great expenditures of money have been made already, in connection with the surveying of the territories which the corporation owns, the Reid Newfoundland Co., who are very largely interested in the scheme, does not anticipate that the work will be discontinued, although activities will no doubt be postponed somewhat by the sudden demise of Mr. Wilson.

At the present time a coal famine prevails at St. John's. Coal is selling for $8.00 per ton, and in a few days it is expected that the price will go much higher.

A Mr. Snow of the district of Trinity Bay made last month what promises to become a most valuable gold find. Mr. Snow is a fisherman of that district, and the find was purely by accident. Several samples were recently subjected to an assay, the yield of gold was large, and in the spring a commencement of operations on the find is authoritatively spoken of.

The steatite for the lining of the furnaces of the smelter now being erected by Mr. W. A. Mackay is now landing from steamer at St. John's. This material has been imported from America.

THE WORLD'S DEEPEST MINE.

Where is the deepest mine in the world? That is a question very few people in this country can answer correctly. Even most mining experts would probably make a wrong guess—unless they had made rather exhaustive inquiries anent the subject—for it is located in a section of the world where you would least expect to find it. In the forests which cover the hills that cluster about the mouth of the mine wild monkeys are chattering and jumping about from limb to limb of the graceful palms which afford them food as well as shelter, while among the bright-hued flowers exquisite orchids waft their perfume and display their beauty for the benefit of these impish progenitors of man. Birds of rare plumage flit in and out among the shadows and the gorgeous red-blue-yellow macaws add their raucous voices to the medley of sounds, while splendid butterflies wave their large wings of iridescent blue and green and gold to enhance the riot of color in these tropic realms.

Tropic realms? Verily, for the deepest mine—gold or of any other metal—is located in Brazil. It is near a place bearing the euphonious name of Villa Nova de Lima, in the State of Minas Geraes, about 330 miles north of Rio de Janeiro. It has been worked, more or less systematically, for something over 80 years, and yet few of us have ever heard of the place, much less of the mine, which is known as the Morro Velho and is owned and operated by an English company.

Last year two young professors of geology, Benjamin Le Roy Miller, of Lehigh University, and Joseph T. Singewald, Jr., of Johns Hopkins, struck out for foreign parts and wended their way even into the hidden recesses of South America with the view of finding out something in regard to the mineral resources of the western hemisphere. They investigated almost all of the known mining districts of the southern continent and brought back with them a vast store of information relative to the mineral wealth of the various countries visited. In Brazil they visited this unusual and in some respects unrivalled gold mine. They tell about it in an article in the December number of the Bulletin of the Pan-American Union (Washington, D.C.), from which the following facts are taken.

The Morro Velho mine is located in the gold belt of Brazil, where the Portuguese were first induced to settle by the discovery of the yellow metal. The first gold was discovered in 1699 near the present city of Ouro Preto. The gold was coated with a black substance and hence was called "ouro preto"—black gold. The city which they founded was long called Villa Rica de Ouro Petro—the Rich City of Black Gold—a name which was somewhat cumbersome even for the Portuguese, so they finally shortened it to just Ouro Preto, the name by which it is known to-day.

Just when the Morro Velho mine was first opened is not known, but it was being operated toward the close of the 18th century, and considerable work had been done when the present company obtained control of it in 1834. The orebody consists of a great vein of unusual persistence and regularity that dips at an angle of about 45 degrees. It may be likened to a gigantic knife blade, held vertically and thrust into the earth at this angle with the point still lower than the present deepest workings. The combined depths of the connected shafts give a total of 5,824 feet. In other words, here is a gold mine that is being worked at a depth of more than a mile below the surface of the earth. Now be it remembered that the rock temperatures increase as the earth's crust is penetrated, in some regions the increase being as much as I degree F. for each 50 to 60 feet increase in depth. At this rate the temperature at the bottom of this mine would be over 100 degrees higher than at the surface, and fried ham and eggs might be prepared for the miners without any other heating apparatus than the loose rocks lying about. Incidentally the miners would be going through the frying process, too. Fortunately, however, in this mine the rate of increase of temperature is only 1 degree for every 100 to 120 feet, giving the rocks a temperature of only 112 degrees. By forcing cool air down into the mine by means of fans the temperature is lowered to a little less than 100 degrees. Even at that it is rather snug, and the miners usually wear only shoes, donning trousers when company is expected. Still, the mine has produced a total of about $55.000.000 worth of gold, and is being worked now at a profit of something over $700,000 annually.

SILVER PRICES.

	New York cents.	London pence.
December, 1915—		
23	54	25 13/16
24	53 7/8	25 3/4
27	53 7/8	Holiday
28	54 1/8	25 7/8
29	54 3/8	26
30	54 7/8	26 3/16
31	55	26 1/4
January, 1916—		
3	55 7/8	26 11/16
4	56 1/8	26 3/4
5	56 1/2	26 7/8
6	56 5/8.	26 7/8
7	56 5/8	26 13/16

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto.)

January 10th, 1916.

New York Curb.

	Bid.	Ask.
Am. Brit. Mfg.	18.00	25.00
Atlanta.	.22	.23
Canada Copper	1.93¾	2.00
Chevrolet Motors (U. S.)	125.00	128.00
Am. Marconi	3.50	3.75
Belmont.	4.50	4.75
Goldfields Cons.	1.06¼	....
Jim Butler	1.09⅜	1.15⅝
Jumbo Extension	1.31¼	1.37½
Standard Oil & Lead (B.C.)	1.81¼	1.93¾
Stewart Mining	.50	.56¼
Tonopah Extension	4.00	4.06¼
Tonopah Merger	.55	.60
Tonopah Mining	6.87½	7.12½
Victoria Oil	2.25	2.50
West End Cons.	.78	.80
Anglo-Amer. Oil	17.50	18.00
Standard Motors	9.25	9.75
Submarine Corp.	41.00	41.50
Maxim Munitions	11.75	12.25
Standard Oil of N. Y.	217.00	220.00
Standard Oil of N. J.	515.00	520.00
Standard Oil (old)	1660.00	.....
Standard Oil (subs)	1150.00	.....

Porcupine Stocks.

	Bid.	Ask.
Apex.	.08⅝	.08¾
Dome Consolidated	.24½	.25
Dome Extension	.37½	.38
Dome Lake	.28	.28½
Dome Mines	28.25	29.00
Eldorado.	.00⅝	.00½
Foley O'Brien	.60	1.00
Gold Reef	.02¼	.03
Hollinger	29.00	29.50
Homestakes.	.37	..
Jupiter	.22½	.22½
McIntyre	1.01	1.02
McIntyre Extension	.29¼	.30
Moneta	.14	.14½
Porcupine Crown	.84½	.86
Porcupine Imperial	.05	.05¼
Porcupine Tisdale	.02⅞	.03
Porcupine Vipond	.73	.75
Preston East Dome	.06½	.06¾
Teck Hughes	.21½	.22½
West Dome	.16½	.16¾

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.04⅞	.05⅛
Beaver	.44	.44½
Buffalo	..	.95
Chambers Ferland	.30¼	.30¾
Coniagas	4.85	..
Crown Reserve	.52½	.54
Foster	.05	.07
Gifford	.08	.08¼
Gould	.00⅞	.01
Great Northern	.04	.04½
Hargraves	.05⅜	.05¾
Hudson Bay	25.00	..
Kerr Lake	4.35	4.65
La Rose	.63	.68
McKinley	.43	.46
Nipissing	7.50	7.75
Ophir.	.09¾	.10
Peterson Lake	.37¼	.37½
Right of Way	.07	.07½
Seneca Superior	.65	.75
Shamrock Cons.	.18¼	.19¼
Silver Leaf	.02⅞	.03⅛
Temiskaming	.70	.70½
Trethewey	.18	.19
York Ontario	.01⅞	.02
Wettlaufer	.08	.09

NEW YORK MARKETS.

Jan. 7.—Connellsville Coke—
Furnace, prompt, $3.00 per ton.
1st half, $2.35 to $2.50; year 1916, $2.25 to $2.35. per ton.
Foundry, prompt, $3.50 to $4.00 per ton.
Foundry, contract, $3.00 to $3.25 per ton.

Jan. 7, 1916.—Straits Tin, f.o.b., nominal, 41.75 cents.
Copper—
Prime Lake, nominal, 23.25 to 23.75 cents.
Electrolytic, nominal, 23.25 to 23.75 cents.
Casting, nominal, 22.25 to 22.75 cents.
Lead, Trust price, 5.90 cents.
Lead, outside, 5.90 cents.
Spelter, prompt western shipment, 17.42½ cents.
Antimony—
English brands, nominal.
American, 42.50 cents.
Chinese and Japanese, 42.50 cents.
Aluminum—
No. 1 Virgin, 98-99 per cent., 54.00 to 56.00 cents.
Pure, 98-99 per cent. remelt, 53.00 to 55.00 cents.
No. 12 alloy remelt, 44.00 to 46.00 cents.
Nickel, 45.00 to 50.00 cents.
Cadmium, nominal, $1.25 to $1.50.
Quicksilver, $175.00.
Platinum—Nominal, $88.00 to $100.00.
Cobalt (metallic), $1.25.
Silver (official), 56⅝ cents.

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base, 30.00 cents.
Copper wire, base, 24.75 to 25.25 cents.
High sheet brass, base, 33.00 to 35.00 cents.
Seamless brass tubing, 36.00 to 38.00 cents.
Seamless copper tubing, 36.00 to 38.00 cents.
Brazed tubing, 37.00 to 39.00 cents.
Brass wire, 33.00 to 35.00 cents.
Brass rods, 33.00 to 35.00.
Sheet zinc, f.o.b. smelter, 23.00 cents.

TORONTO MARKETS.

Jan. 11, 1916—(Quotations from Canada Metal Co., Toronto)
Spelter, 21 cents per lb.
Lead, 7¼ cents per lb.
Tin, 42 cents per lb.
Antimony, 48 cents per lb.
Copper casting, 22¼ cents per lb.
Electrolytic, 22¾ cents per lb.
Ingot brass, yellow, 13c.; red, 15c. per lb,

Jan. 11, 1916—(Quotations from Elias Rogers Co., Toronto)
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

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CANADA

DEPARTMENT OF MINES
GEOLOGICAL SURVEY

RECENT PUBLICATIONS

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CANADA
Summary Report of the Geological Survey for the year 1914.
Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.

NEW BRUNSWICK and NOVA SCOTIA
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.

QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
Memoir 72. The Artesian Wells of Montreal, by C. L. Cumming.
Memoir 73. The Pleistocene and Recent Deposits of the Island of Montreal, by J. Stansfield.

ONTARIO
Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

BRITISH COLUMBIA
Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
Memoir 68. A Geological Reconnaissance between Golden and Kamloops, B.C., along the Canadian Pacific Railway, by R. A. Daly.
Memoir 79. Ore Deposits of the Beaverdell Map-Area, by Leopold Reinecke.
Memoir 76. Geology of the Cranbrook Map-Area, British Columbia, by S. J. Schofield.

YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

MAPS:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.

QUEBEC
Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.
Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 143A. Shuswap Lake, Kamloops District, B.C. Geology.

YUKON AND NORTH-WEST TERRITORIES
Maps 140A and 141A. Southern and Northern Sheets of the Yukon-Alaska International Boundary between Yukon and Porcupine Rivers. Geology.
Map 122A. Upper White River District, Yukon Territory. Topography.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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Canadian Miner's Buying Directory.—(Continued from page 16.)

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Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
M. Beatty & Sons.

Smelting Machinery—
Fraser & Chalmers of Canada, Limited

Stacks—Smoke Stacks—
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Stamp Mills—
Fraser & Chalmers of Canada, Limited

Steel Drills—
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Northern Canada Supply Co.
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Steel—Tool—
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W. F. Stanley.
C. L. Berger.

Tanks—Cyanide, Etc.—
Fraser & Chalmers of Canada, Limited
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Transformers—
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Transits—
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Northern Canada Supply Co.
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Roessler & Hasslacher.

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Metal Mining in British Columbia in 1915

Metallurgy of Cobalt Silver Ores

Utilization of Bituminous Sands of Alberta

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CONTENTS

A NICKEL REFINERY FOR CANADA

The nickel question is up again. It was the chief topic of discussion at the meeting of the Toronto branch of the Canadian Mining Institute on Saturday, January 15. A few days later the interest of the general public was revived by newspaper reports to the effect that the refining of nickel in Canada is likely to be undertaken at an early date. We hope that these reports will prove well founded. In view of the circumstances they seem not unlikely to be so.

On January 19 the following item appeared in a Boston financial paper: "Canada's resolution to refine its own production of nickel is endorsed by International Nickel Co., who declare they will undoubtedly, when the time comes, erect refinery there to work on the 80 per cent. of world's nickel supply which Canada produces. International Co. now refines three-fourths of it."

On January 22 the same paper published the following: "International Nickel Co. has decided to erect a nickel refinery in Canada. In this respect it is stated that the company desires to co-operate with the Canadian Government in its desire to have some of the nickel ore mined in the Sudbury district of Canada refined in the Dominion. Pres. Monell recently returned from Canada after conferring with officials of the Dominion. The arrangement is said to be satisfactory to both the Canadian Government and the company."

About the same time Ottawa correspondents of Toronto papers sent out news items on the same subject. The Toronto World, which is largely responsible for the great public interest in the nickel question, had in its issue of January 21 the following item from a staff reporter at Ottawa:

"Negotiations are almost completed for the establishment of a nickel refinery in Canada by the International Nickel Company, which has control of the Sudbury nickel mines. The refinery will be situated in Cape Breton, N.S., and henceforward all the nickel material which has hitherto gone to New Jersey for refining will be refined in Canada. The export of nickel from Canada is to be controlled completely by the Government in order to insure a steady supply for the allies for the manufacture of armaments for field and naval purposes, and to render it certain that no Canadian nickel will find its way to the enemy."

Under the same date The Globe published the following: "The recent visit to Ottawa of Mr. Ambrose Monell, the creator of the International Nickel Company and the industry which it represents, has resulted in the announcement that arrangements have been made whereby the final processes of refining nickel in Canada will be

completed in this country by the corporation of which Mr. Monell is the moving spirit. It is reported that an understanding has been reached between the Dominion Government and the International Nickel Company whereby a nickel refinery will be established on the Atlantic seaboard. This departure is understood to be dictated entirely by economic conditions, the destination of the output of the Ontario nickel mines never having been the cause of any anxiety to the Government of either Canada or Great Britain. Since the war began, there has been close co-operation between the International Nickel Corporation and the British War Office and largely through the increased activity of the Canadian nickel mines the requirements of Great Britain and her allies have been satisfied. The new arrangement, however, will mean an important addition to the list of industries which will be opened somewhere near the time that peace is declared."

Other newspapers have published similar statements concerning the significance of Mr. Monell's visit to Ottawa, all accepting as plausible the report that a refinery will be established in Canada; but differing widely in opinion as to why and when it will be established and what part of the nickel matte produced will be refined here.

According to the Boston News Bureau of January 19 the International Nickel Company will erect a refinery in Canada—"when the time comes." We are naturally interested in knowing what is meant by this significant phrase. Does it mean that the company expects the Canadian Government to insist on refining being done here? Apparently it does. Does it mean that all the refining will have to be done here? On this point the reports vary, one answers the question affirmatively and the other negatively.

The Toronto World, which invited our hostile criticism by demanding a year ago an embargo on the export of nickel matte to the United States, seems to interpret the news item as an indication of the Government's dissatisfaction with the present arrangements for preventing nickel from reaching the enemy. It may be true that some Canadian nickel is reaching Germany; but if so a great many people whose business it is to know what is going on are being grossly deceived. We have had no good reason yet to conclude that such is the case. It is obvious that Germany has been making every attempt to procure nickel and she may have succeeded in some cases. The British Admiralty is, however, in a position to secure necessary information in this connection and the Government has reported that present arrangements are satisfactory.

It is possible that since the Government assurances were given that control of export has been lost and that nickel is now reaching the enemy. It may be that the Government has obtained reliable information of such traffic and has determined to insist on all the refining being done here. We have no information to this effect, however, and consider it quite unlikely.

While we disagree with the World concerning this phase of the nickel question we agree with its contention that steps should be taken to have the refining done in Canada. It is obviously to the advantage of Canada and the mining industry that we should send out finished rather than raw materials. We would rather export nickel than nickel matte; further, we would like to export nickel steel instead of nickel for the manufacture elsewhere of nickel steel and we would prefer to export nickel-plated articles instead of nickel for plating.

We agree also with the World that it is regrettable that in a time like the present we are dependent on a foreign plant for the production of refined nickel. We take issue on the question of how this condition should be remedied. The World seems unwilling to believe that the International Nickel Company is not exploiting Canada in the interests of Germany. We prefer to believe that the company is in business primarily to make money, and that the directors consider the present arrangements satisfactory on account of business reasons and not from a desire to deprive Canada of an industry or to further the interests of Germany.

We have therefore expressed in these columns satisfaction with the present arrangements as being in the best interests of Canada and of the company. By placing an embargo on nickel matte we would be depriving the Empire and a friendly country of needed supplies. By failing to take precautions satisfactory to the British Admiralty for preventing nickel from reaching our enemy, the International Nickel Company would put itself in a position which would force Canada to prohibit the export of nickel matte to the United States. It is obvious that the company is not anxious to bring about such a condition of affairs.

We have also expressed on former occasions a desire to see nickel refineries established here if such a change can be made without unfairly treating the company which is chiefly responsible for the existence of Canada's nickel industry. It is not unlikely that the company would be willing to make some concessions in view of the large profits that are being made and of the feeling in Canada with regard to the question, and we imagine that the company could establish a refinery in Canada and still be able to pay dividends. We consider, however, that there should be more disposition to meet the company half way and we have no sympathy with the demand that the company be forced to abandon its New Jersey plants.

In the Globe's comment, quoted above, it is hinted that a nickel refinery will be established about the time that peace is declared. The authority for that statement is not given by the Globe. Is there any connection between these remarks and the statement in the Boston News Bureau that a nickel refinery will be established in Canada "when the time comes?"

We fail to see why the end of the war should be chosen as the time for adding to Canada's industries. To our mind the time is now. The demand for nickel and copper was never so great as to-day. The output of the

Sudbury district was never so large. It is evident that if the increased demand is to be met by increased production there must be increase in plant. If there is to be increase in plant, is not now the time to begin construction of a refinery in Canada? It could take care of the new business and gradually be extended to meet the demands for increased output which is bound to come. The New Jersey plant, instead of being scrapped, could be used to supply part of the market under the present restrictions. Before the time comes for the lifting of the present restrictions consideration should be given to the advisability of providing that the New Jersey plant should be used only for supplying the United States market.

THAT COPPER RULING

News despatches recently have credited the British Government with making a rule that the price of copper must not exceed £100 per ton—equal to about 21 cents per pound. Naturally there have been adverse comments on what appears an arbitrary measure to fix the price of a commodity which England must obtain abroad and chiefly in the United States.

As the Journal of Commerce points out, such a ruling might prevent British munitions manufacturers from obtaining copper. "In that case the British factories will have to close, and the orders for munitions will have to be sent to the United States and Canada, where manufacturers are free to buy their copper in such quantities and at such prices as the market conditions may allow. Such a result would not meet the purposes which the Government had in view. They desired to guard against the excessive price of an article absolutely necessary in the production of munitions. They may have to come to the conclusion that it is better to have copper at a high price than not to have it at all."

The wording of the ruling is, however, worthy of consideration. It states that no order should be placed at prices exceeding £100 per ton "without first consulting the director of materials." The news despatches have omitted these significant words.

CANADIAN MINING INSTITUTE

There is to be no election of officers at the meeting of the Canadian Mining Institute in March, but there are indications that the business session will be enlivened by discussions on the by-laws. At least two amendments have been drawn up and submitted for consideration at the meeting.

One of these amendments would provide that certain matters now decided at the annual meetings should be decided by letter ballot. From what we have heard of this proposal it is apparently the opinion of Mr. Norman Fisher and Mr. B. Neilly, who are proposing this amendment, that the present method is unfair to the large number of members who are unable to attend the meetings and are thus deprived of a vote. Most of us agree with them in this. It is generally acknowledged that there are good grounds for dissatisfaction with the present practice. Many members live so far from the places of meeting that they are seldom able to attend. It is not desirable that they should be deprived of an opportunity to vote on some of the questions which are now decided at the annual meetings. On the other hand the business sessions would lose most of their interest if questions of importance could not be decided there. Most of the members who attend the business sessions do so because something is to be decided there and because they want to hear or take part in the discussion. If no decision was to be arrived at the session would lose nine-tenths of its interest. The proposal merits consideration. It is not an easy matter to decide which method of voting is in the best interests of the Institute.

The Temiskaming Mining Company directors have a particularly interesting report to present at the annual meeting, the date of which has not yet been set. The year 1915 was a very successful one and the prospects are even better, for important additions have been made to ore reserves. President F. L. Culver deserves great credit for the able manner in which he has handled the company's affairs.

The excellent inspection system at the Beaver mine has attracted much attention. Numerous favorable comments have been made on it and the Chief Inspector of Mines of Ontario, Mr. T. F. Sutherland, has pointed it out many times as a good example. A recent publication of the U. S. Bureau of Mines pays the management of the Beaver a well deserved compliment by singling out the Beaver system as the best in America for a small mine.

The Nova Scotia Steel and Coal Co. has decided to enlarge the plant at New Glasgow. A new open hearth furnace of 200 tons capacity and a plant for forging shells have been contracted for.

American mining companies paid in dividends in 1915 the sum of $75,383,387 as compared with $60,323,529 in 1914.

Deep in the German mind was the sentiment that robbery is not robbery when Germans steal for Germany; deep in the German mind was the sentiment that to get by force is as good a way as any. So, having got by industry what was to be had, Germany has published her creed: "Property first, righteousness at convenience." We have all seen the document sealed with blood of Belgium. We have all accepted notice that Germany is for Germany, property first, and all of us who are not Germans admit that Germany on her present basis is of all the nations the most powerful enemy of peace.—Life.

INTERNATIONAL NICKEL CO.

New York, Jan. 26.

International Nickel Co. in the three months ended Dec. 31 earned 6.8 per cent. on $41,834,600 common stock, and in the nine months ended Dec. 31 earned 19.4 per cent. on the same amount of stock.

The following tabulation shows the income account for the three and nine months periods ended Dec. 31, 1915:

	Three mos. end. Dec. 31	Nine mos. end. Dec. 31
Gross	$3,541,776	$10,209,531
Other income	65,496	168,449
Total income	3,607,272	10,377,980
Administration and gen. exp.	184,026	636,152
Net income	3,423,246	9,741,828
Depreciation, mineral exhaust.	464,704	1,215,867
Surplus	2,958,541	8,525,960
Preferred dividend	133,689	401,067
Balance for common	2,824,852	8,124,893
Per cent. on common	6.8	19.4
Common dividend	2,091,730	3,993,305
Surplus	733,122	4,131,588

In three months ended Dec. 31, International Nickel Co. had a balance equivalent to about 7 per cent. on the common stock, or at rate of 28 per cent. for the year. This takes into consideration the stock issued in payment of the 10 per cent. stock dividend.

In the first nine months of the current fiscal year, after allowing all charges for depreciation, mineral exhaustion, and preferred dividends, the company earned about 20 per cent. on the increased common stock. Thus the full year's cash dividends were earned in nine months.

Gross in quarter ended with December was greater than any previous quarter. The current quarter is expected to show even a bigger gross. It is expected that last half of the fiscal year will show gross fully 50 per cent. in excess of the first six months, with a commensurate gain in balance for dividends.

Cash balance at close of the fiscal year, March 31, if no extra dividend is charged out in the meantime, will approximate 25 per cent. on the common. There is every reason to believe common shareholders will receive a substantial extra cash dividend in the near future.

REFINING AND USES OF NICKEL

In "The Globe," Toronto, under date of Jan. 21, is an interesting unsigned contribution on nickel. We print it below with a few changes which have been made to correct what are obviously typographical errors:

The establishment of a nickel refining plant in Canada will be a considerable economic problem, as it will entail increased cost of sulphur—sulphur-free, free oils, coke, nitre cake, fire brick, fire clay, magnesite brick and coal. Until now the refining has been done at Bayonne, New Jersey, adjacent to the great oil refineries and chemical plants.

In the ordinary process the ore mined in the Sudbury district by the International Nickel Co. is transported to the smelter at Copper Cliff, and is there smelted by successive stages into a product known as copper-nickel matte, containing approximately 55 per cent. nickel, 25 per cent. copper and 20 per cent. sulphur. All of this matte has been shipped to the Bayonne refinery, where the nickel and copper have been separated from each other, the copper being advanced to the form of electrolytic copper and sold in the market.

The shipment of nickel matte is analogous to that condition existing throughout the copper industry of the United States, in which it is the general practice for the copper producers to bring their products to the stage known as blister copper at a smelter close to their mines, and then transport the blister copper to some central refinery, advantageously situated where the supplies and the power necessary for its economical subsequent refining into a marketable product are cheap, in many cases this distance being thousands of miles.

Nickel, after being separated from the copper, is refined to a high degree of purity, of approximately 99 per cent., and sold to consumers in the United States, Canada and foreign countries.

Nickel is not sold by the company in the form of a finished article of merchandise reaching consumers directly. It is in the form of a crude metal that is alloyed with other metals and then fabricated into ingots, bars, sheets, strips and other similar metallic products, from which a finished article that reaches the consumer is made. Contrary to general belief, nickel production no longer depends upon naval armaments or martial requirements. Nickel steel in varied forms is used in a wide range of industrial operations, as well as in the manufacture of ordnance and projectiles.

The property of toughness which nickel imparts to steel has rendered its adoption for industrial purposes of expanding importance. Large quantities of plate were used in connection with the reconstruction of the Quebec bridge; the construction of the Manhattan and Queensborough bridges in New York city; the St. Louis bridge over the Mississippi; the Kansas City viaduct and bridge over the Missouri; the Emergency dam, locks and spillway in the Panama Canal, and in many other smaller structures. Nickel has entered into all sorts of railway materials, marine engines and propeller shafts, and a thousand and one lines of manufacturing trades. Armor plate, protective deck plates, large and small guns, armor piercing projectiles, gun shields, etc., contain nickel, but they constitute a small portion of the market for the metal. Manufacturers of alloyed metals—German silver manufactures, for example—cover a large field. In their products, copper-nickel and zinc form component parts. These alloys vary in their nickel contents according to their uses and to the whiteness and softness of the metal to be produced. They enter into hardware and plumbing supplies, tableware, dairy machinery, railway car fittings, electrical resistance materials, cartridge shells, bullet jackets and coinage, both in German silver and pure nickel. The non-corrosive qualities of pure nickel make it specially desirable for cooking utensils, surgical instruments and like purposes. Monel metal—the natural nickel-copper alloy, has found a large market for many uses. Nickel was introduced into the manufacture of the Edison storage batteries, and is much sought in the automobile trade.

SILVER STOCKS IN NEW YORK

Boston, Jan. 21—Approximating 3,000,000 ounces of silver at New York and San Francisco represents the holdings of the silver sales agencies at the present time according to estimates of the best posted interests. In the closing months of 1915 the accumulation got as high as 7,000,000 ounces, but a spurt, which lasted about two weeks, took away about 4,000,000 ounces in that time. This metal was shipped abroad.

DOMINION COAL

The corrected totals of the Dominion Coal Company's production in 1915 are as follows. The production of 1914 is given for comparison.

	1915	1914
Glace Bay Collieries.......	4,608,979	4,287,717
Springhill Mines..........	400,791	417,406
	5,009,770	4,705,123

Increase over 1914: 304,647 tons.

The output for January will be around 390,000 tons from the Glace Bay mines and 38,000 tons from Springhill, comparing with 256,000 from Glace Bay and 31,000 from Springhill in January last. If these figures are realized the first month of 1916 will show an appreciation in production of over 140,000 tons compared with the first month of 1915. This large production has become possible because the collieries are working steadily every day, a very unusual condition in January. Last January the mines were working only intermittently, and at very little over half capacity.

Practically all the coal that is being mined is also being shipped, and only small quantities are being stored in banks.

Taking Nova Scotia as a whole the production and shipments in January 1916 will be the largest in the history of coal mining in the Province. It may also be remarked that it is the first time that the Nova Scotian collieries have been able to show what they could do in January, because for the first time, at this season of the year, the demand has been about equal to the supply.

BETHLEHEM STEEL

Bethlehem Steel common sold at $600 in October, when predictions were freely made that the European war would be over by spring of this year.

It is now selling below $500, with a $30 dividend to come of this year, and prospects that there will be no termination of the war before fall. By that time Bethlehem Steel will have practically completed its present European contracts, in which case the most optimistic forecasts of earnings for 1916 will be realized. It means that Bethlehem will earn for its common stock this year $400 a share or more.

If the European war continues into the latter part of the year, long before then the Bethlehem Co. will be deluged with another big batch of foreign war orders, and estimates of earnings for the year 1917 will be in order.

It is expected that 9,000,000 shells will be completed and delivered in the first ten months of this year. Estimating $6 as profit per shell, earnings on these 9,000,000 shells alone would reach $54,000,000.

With two months of the year to go, and profits from guns and other classes of ordnance, rails, structural and commercial steel, estimates of $400 a share upward for the common in 1916 are not to be wondered at.

Pres. McGregor of Union Iron Works of San Francisco has been in New York consulting with Bethlehem Steel officials relative to enlargement of the Union plant, which is a subsidiary of Bethlehem Steel. Vice-Pres. Snyder of Bethlehem Steel Corporation has returned from inspection of the Union works.—Boston News Bureau.

HARGRAVES

According to a Toronto Mining Broker the Hargraves is under option to New York interests, with every chance of the deal being consummated early in February. The work on this property in the past has been chiefly on veins which were not highly productive. Some good ore was taken out near the Kerr Lake boundary.

U. S. OIL PRICES

Houston, Tex., Jan. 21—Magnolia Petroleum Co., Pierce-Fordyce Oil Association and Bonner Oil Co. advanced gasolene, tank wagon basis, and at filling stations, two cents a gallon to 19 and 21 cents, respectively. Kerosene prices have been advanced one cent a gallon to 12 cents, and naptha two cents a gallon to 17 cents, tank wagon basis.

Neither Gulf Refining Co. nor Texas Co. has raised prices to meet the new schedule, but both are expected to do so before the end of the week. Demand for all grades of oil is exceptionally strong. Cold weather apparently has no effect on consumption of gasolene, and all companies report a capacity business.

Independence, Kansas—Prairie Oil & Gas Co. advanced price of Mid-Continent crude 5 cents to $1.25 a barrel.

INTERNATIONAL NICKEL

"International Nickel directors meet for action on the common dividend February 7, and it is expected that an extra dividend will be declared, in addition to the regular 5 per cent. Little credence is given in Wall Street to the report that the Canadian Government is contemplating action that would result in the company being forced to refine its ore in the Dominion. This question has been discussed several times, and the company has always succeeded in convincing officials of the economies that are possible in refining the ore at its Bayonne, N.J., plant. There are two reasons due to the war, why Canada might consider such a change. The first would be to prevent Great Britain's enemies from obtaining the metal which in its raw state, was produced in Canada. Second, to prevent an inflation in the price which would hinder its use in the production of munitions, automobiles and other necessities of war."—*Financial Times.*

APEX.

The shareholders of the Apex Mining Company at a meeting Monday, Jan. 24, in the offices of Sir Henry M. Pellatt, unanimously ratified a bylaw authorizing the directors to sell 699,991 shares of treasury stock at not less than 15c a share. The shareholders are to be given the privilege of subscribing pro rata to this issue up to Feb. 15. It was announced at the meeting by Mr. A. M. Bilsky, who presided, that a brokerage house in Montreal had signified its intention to deal along these lines for this block of stock.

BOSTON CREEK.

Boston Creek, Ont., Jan. 20—The Miller Independence Mining Syndicate has completed the installation of boiler and machinery and the work of getting the plant in shape is proceeding satisfactor ly. Up to Saturday ten barrels of ore worth approximately $15,000 was in the ore house.

It is reported here on good authority that the Richardson, Albright Papasimakes Mining and Development syndicate holdings have changed hands, the price being $200,000.

ADANAC

An important strike at the Adanac mine, south west of the Temiskaming, is reported. According to the reports received rich ore was encountered in sinking a winze from the 200 ft. level.

TRIUMPH

The Triumph Mining Co., has taken over and is developing the Success company's property near the Vipond mine.

THE METALLURGY OF CANADIAN COBALT ORES

II. LOSS OF SILVER IN CHLORIDIZING SPEISS

By Ralph W. Bridges

The Canadian Copper Company of Copper Cliff, Ontario, was one of the pioneers in the successful smelting of Cobalt ore from the Northern Ontario mines. As early as 1905, they had purchased a few cars of high grade ore and were doing experimental work to determine the best methods of recovering the metals cobalt, nickel, silver and arsenic.

By direct smelting 80% to 85% of the silver was easily obtained in the form of crude silver buttons, but the remaining 15% to 20% was held up in the speiss along with the cobalt and nickel.

The average assay of the metal contained in 12 lots of speiss, shown in the first part of Table No. 3, is:—

Silver 1581 oz. per ton; Arsenic 26.29%; Cobalt 18.76%; Nickel 7.82%; Iron 20.15%.

This analysis shows the complex nature of the material and indicates the difficulty of the metallurgical problems to be encountered in separating the various metals. At first this speiss was sold to lead smelters, where it was smelted along with lead ore. Thus the silver was recovered while the other metals were lost in the slag.

The writer of this article was in charge of the experimental work at the cobalt plant at Copper Cliff when it was decided to make a thorough investigation of chloridizing, leaching out, precipitating and refining the silver to be found in the speiss.

As the whole proposition would be impracticable if the loss of silver was large in the roasting, the first thing to do was to determine the loss of silver during the roasting process.

This thesis deals with the experiments which were conducted to determine this loss.

Roasting was first done on a small scale, using the muffle furnaces which were in the laboratory for the fire assay work. Two sets of roasts were made, mixing the speiss with 15% salt in the first and with 20% salt in the second. The weight of the speiss was the same in each case, i.e., 4000 grams ground to pass 40 mesh. Each charge was roasted for 10 hours at dull red heat and rubbed often enough to prevent lumps from forming. The results of these experiments are shown in Table No. 1. The silver content, before and after roasting, is figured just as if each gram represented a pound. This makes the laboratory experiments easily compared with those conducted on a larger scale.

By increasing the salt from 15% to 20% the volatile loss was raised from 1.88% to 3.27%, or almost doubled.

As no provision was made for collecting the dust and fumes given off from the small muffle furnaces the writer determined to run two 5 ton lots in our Edwards furnaces, which were equipped with flue dust and fume condensing chambers. 15% of salt was used and with the addition of the silver contained in the flue dust the loss was only 1.18% or very reasonable. (See Table No. 2).

Arrangements were now made with the Orford Copper Company to purchase the speiss as chloro-speiss, for a run of three months. It was determined to keep a complete record of the material charged and discharged from the roaster and at the end make a careful clean-up of flue dust, crude arsenic, etc., and credit their silver content to the experiment. The volume of material was so large in this case that the possibility of error was reduced to the minimum. Complete figures covering this three-months test are shown in Table No. 3. The speiss was milled to pass 40 mesh and 15% of salt was added as the speiss was charged to the ball mill. Twelve lots of green speiss were milled and roasted, having a total silver content of 377,255.81 oz. Nine shipments of chloro-speiss were made to the Orford Copper Company of Camden, N.J. Three lots of rejected chloro-speiss were returned to the process. All speiss which contained more than 40 oz. of silver insoluble in sodium hyposulphite was rejected. When the silver content of the flue dust and crude arsenic was added to the other roaster products there was a total credit of 376,140.97 oz. of silver, giving a loss of 1114.84 oz. or only 0.29%.

As a result of this final test the chloridizing of the speiss was shown to be a safe proposition and all the green speiss produced in the cobalt plant thereafter, was chloridized in the Edwards furnaces.

After more experimental work was done on leaching processes for the recovery of silver from chloro-speiss a hypo-leaching plant was built and put into successful operation thus making it possible to recover all the silver from the ore at the cobalt plant.

TABLE I.

Series A, Speiss Roasted in Muffle Furnaces with 15% Salt. (Weight in Grains).

No.	Weight of Speiss	Weight of Salt	Total Weight	Wt. After Roast	Gain in Weight	Assay Silver Before R.	Assay Silver After R.	Silver Content Before R.	Silver Content After R.	Oz Silver Lost	Per Cent Sil. Lost
1	4000	600	4600	5082	482	903.5	709.0	1807	1801	6	
2	4000	600	4600	5288	688	1221.6	897.0	2443	2373	70	
3	4000	600	4600	5140	540	1221.6	927.0	2443	2382	61	
4	4000	600	4600	5300	700	1221.6	908.0	2443	2407	36	
								9136		173	1.88%
				Series B Speiss, Roasted with 20% Salt.							
1	4000	800	4800	5289	489	1486.9	1100.0	2974	2909	65	
2	4000	800	4800	5241	441	1060.0	776.0	2120	2034	86	
3	4000	800	4800	5026	226	1060.0	812.0	2120	2041	79	
4	4000	890	4800	5290	490	1060.0	773.0	2120	2045	75	
								9334		305	3.27%

TABLE II.

Speiss Roasted in Edwards Furnace with 15% Salt. (Weights in Pounds)

No.	Weight of Speiss	Weight of Salt	Total Weight	Wt. After Roast	Gain in Weight	Assay Silver Before R.	Assay Silver After R.	Silver Content Before R.	Silver Content After R.	Oz. Silver Lost	Per Cent Sil. Lost
1	10,000	1500	11500	12295	1195	1182.0	917.6	5910	5641		
Weight of flue dust, clinker, etc				3176			115.0		183		
								5910	5824	86	1.46%
2	10000	1500	11500	13025	2525	1092.6	816.9	5463	5320		
Weight of flue dust, clinker etc.				1146			164.7		94		
								5463	5414	49	0.90%
								11.373		135	1.18%

TABLE III.

Results of Three Months Test of Roasting Process

Speiss Charged to Roasters

Lot	Dry Weight	Assay Co.	Assay Ni.	Assay As.	Assay Ag.	Metallic Content Cobalt	Metallic Content Nickel	Metallic Content Arsenic	Metallic Content Silver Oz.
212	43715	17.62	10.00	21.30	1648.43	7703	4372	9311	36039.30
213	69838	19.18	10.13	25.20	1293.00	13395	7095	17599	45150.27
214	53634	14.82	6.70	23.85	1962.65	7949	3593	12792	52632.39
215	68917	19.24	5.85	30.35	1653.43	13259	4031	20916	56974.71
216	33043	19.70	7.10	22.75	1702.45	6509	2346	7517	28127.03
217	51790	20.86	7.54	27.65	1436.71	10803	3905	14320	37203.61
218	48715	19.03	7.56	27.75	1472.16	9270	3683	13518	35858.14
219	31940	18.83	8.35	28.05	1292.30	6014	2667	8959	20638.03
220	12320	19.61	9.44	29.85	1556.18	2417	1164	3679	9590.74
221	10811	18.02	6.86	24.95	1598.17	1948	742	2611	8638.91
222	10757	17.97	7.77	23.65	1695.90	1933	836	2544	9121.40
223	41683	19.84	6.95	27.90	1788.80	8270	2897	11630	37281.28
									377255.81

Credits for the above roasting; 9 lots of Chloro-Speiss shipped to Orford Copper Co., 3 lots of rejected Speiss, Flue Dust and Crude Arsenic.

Lot	Dry Weight	Assay Co.	Assay Ni.	Assay As.	Assay Ag.	Metallic Content Cobalt	Metallic Content Nickel	Metallic Content Arsenic	Metallic Content Silver Oz.
156	38066	15.96	8.77	14.03	1334.50	6975	3338	5341	25399.54
157	56284	16.35	8.75	13.95	1189.90	9202	4925	7852	33401.74
158	46407	14.17	7.39	10.10	1534.20	6576	3429	4687	35598.81
159	49941	15.95	6.07	22.20	1365.90	7966	3031	11087	34107.21
160	44447	16.76	6.12	15.35	1525.40	7449	2720	6823	33899.73
Reject	50505	14.86	6.70	20.20	1329.10	7505	3384	10202	33562.07
161	52371	17.71	6.74	16.90	1360.30	9275	3530	8851	35633.23
162	50077	17.91	6.98	13.75	1304.37	8969	3495	6886	32658.82
163	49070	17.02	7.06	22.85	1240.30	8352	3464	11212	30430.76
164	41166	17.42	6.45	23.50	1544.80	7171	2655	9674	31796.62
Reject	46465	14.95	5.92	23.20	1197.70	6947	2751	10770	27825.57
Flue dust	3305	18.42	2.33	15.10	669.50	609	77	499	1106.35
Reject	30845	15.44	6.87	21.40	1267.30	4762	2119	6601	19544.93
Crude Ars.	16781	3.90	2.08	52.30	211.50	654	349	8771	1774.59
									376140.97
								Loss in Silver............	1114.84
								Per cent loss..........	0.29%

MINING IN BRITISH COLUMBIA IN 1915

By E. Jacobs.

The mining industry of British Columbia showed improvement in 1915 over results obtained in 1914. An estimate of total value of the mineral production of 1915 places the amount at $29,979,000, as compared with $26,388,825, which was the revised total on official record of the value of the production of 1914. The increase in value, therefore, appears to have been $3,490,175. However, since there were differences in average prices of some of the metals, this does not show the actual position, which is better indicated in the table that follows, giving the estimated quantities of minerals produced (save only as to miscellaneous products) and exhibiting the year's changes in totals of production of individual minerals.

Estimated Mineral Production of British Columbia in 1915.

Mineral.		Quantity.		Increase or Decrease over 1914.
Gold, placer	oz.	34,500	I.	6,250
Gold, lode	oz.	257,690	I.	10,520
Silver	oz.	3,670,144	I.	67,964
Lead	lb.	45,306,000	D.	5,319,043
Copper	lb.	57,382,294	I.	2,372,595
Zinc	lb.	11,940,000	I.	4,073,533
Coal	tons, 2240 lb.	1,552,000	D.	258,967
Coke	tons, 2240 lb.	248,424	I.	13 827
Miscellaneous products		$2,000,000	D.	$ 852,917

As the year 1914 was not an ordinary one, for the reason that war conditions brought about the closing in August of many metalliferous mines, some of which were operated during the greater part of 1915, the comparison of results obtained in those years respectively, is hardly a fair one. On the other hand the general position was much more favorable in 1913, so that comparison with that year's production would also be on inequitable basis, in this case against 1915. Yet, this notwithstanding, the following changes in 1915 as compared with 1913 may be stated. Placer gold I. 9000 oz.; lode gold, D. 14,564 oz.; silver, 1. 204,288 oz.; lead, D. 10,058,677 lb.; copper, I. 10,921,989 lb.; zinc, I. 5,181,232 lb.; coal, D. 585,483 tons; coke, D. 37,621 tons; miscellaneous products, D. $1,198,100. While these figures show that there were several large decreases, there were substantial increases in other minerals that in point of money value went far to compensate for the decreases, so that, on the whole, last year does not suffer very much by this second comparison.

Gold. Of the total of 34,500 oz. of placer gold from the whole province, the proportion credited to Cariboo district is 13,750 oz. and that to Cassiar district 18,500 oz., of which latter 17,000 oz. is estimated as Atlin's share and 1500 oz. that of Liard and Stikine divisions of Cassiar. Of the remaining 2250 oz., the apportionment is 500 oz. to Fort Steele division of East Kootenay; 400 oz. each to Omineca and Similkameen; 250 oz. each to Lillooet and Nelson; and 450 oz. is the total of several smaller producers.

Lode gold came in largest part from Rossland mines, which are estimated to have produced fully 60 per cent. of the province's total of nearly 258,000 oz.; Boundary district mines, excluding Similkameen, came next with a little more than 17 per cent., including about 37,000 oz. from the Granby Co's mines, nearly 4000 oz. from the B.C. Copper Co's mines, and 2600 oz. from the Jewel mine. The Hedley Gold Mining Co's Nickel Plate mine, Similkameen, made its customary annual production of between 38,000 and 40,000 oz. Mines in Nelson division of West Kootenay yielded between 8000 and 9000 oz. about one-half of which came from the Queen mine, Sheep creek, while the Motherlode, in the same camp, and the Relief, at Erie, added appreciably to the total of this division. From mines near the Pacific coast came fully 10,000 oz., of which nearly one-half was from the Granby Consolidated Co's Hidden Creek mine, near Observatory Inlet, and the remainder chiefly from the Marble Bay mine, Texada Island, the Rocher Deboule Co's copper-gold mine in the Skeena country, and the Engineer gold mine near Atlin.

Silver. Of an estimated total of 3,670,000 oz. of silver for the province, it is thought that between 2,200,000 and 2,300,000 oz. was produced from mines in the Ainsworth-Slocan district of West Kootenay, roughly rather more than 1,900,000 oz. from Slocan mines and than 300,000 oz. from Ainsworth mines. It seems probable that when the revised returns shall be in it will be found that the 1915 production of silver from these mines was larger than that of 1913 notwithstanding that the latter year was free from war and market troubles and too, had the benefit of a higher average price for the year than did 1915. Probably more than 40 per cent. of the Slocan total came from the Standard mine, near Silverton; the Hewitt-Lorna Doone in the same camp was next with an output of several hundred thousand ounces of this metal, and then the Surprise mine near Cody with between 200,000 and 250,000 oz. More than a dozen other mines in Slocan and half a dozen in Slocan City division together contributed to the total output of the district, from a few hundred ounces each from some small mines up to the considerable combined production of the Rambler-Cariboo, Lucky Thought, Slocan Star, Ruth Hope, and Mountain Con.

Of the Ainsworth mines, the Consolidated Co's No.1 is estimated to have produced in excess of 200,000 oz. while the Utica, Cork-Province, Bluebell, and the Retallack Co's mine together added more than half that quantity, and half-a-dozen others each also yielded silver.

By far the greater part of the 600,000 oz. estimated as the production of East Kootenay mines was from the Consolidated Co's Sullivan mine, while the same company's St. Eugene mine yielded a few thousand ounces and the Monarch near Field, in the northern part of this district did likewise.

Boundary district mines produced a much decreased quantity of silver as compared with other recent years. Their total last year appears to have been less than 300,000 oz. and that notwithstanding that the Granby Co's mines, with a total of about 195,000 oz., did a little better than in 1914. The Union mine, in Franklin camp, probably produced 25,000 oz., but this is a surmise. Other Boundary producers were the E.P.U., Mother Lode, Jewel, and Skylark, all near Greenwood, and the Sally up the west fork of Kettle river.

Next in quantity from one district was Skeena, with about 167,000 oz. from the Granby Co's Hidden Creek mine, 22,000 oz. from the Rocher Deboule Co's mine, and approximately 50,000 oz. from several mines in the neighborhood of New Hazelton.

Rossland mines are estimated to have produced about 156,000 oz., of which nearly 25,000 oz. was from the Le Roi No. 2 company's Josie group and the large remainder from the Consolidated Co.'s Centre Star and Le Roi groups of mines.

The output of mines in the lower Coast district was about 72,000 oz., of which quantity the Britannia's proportion was 55,000 oz. and that of the Marble Bay mine, on

Texada island, more than one fourth of that amount. Other parts which yielded much smaller quantities of silver were Trout Lake and Nelson divisions, Camp Hedley, and Northeast Kootenay.

Lead—Mines in the province producing lead in considerable quantity are not nearly so numerous as those from which gold or silver, or both these metals are obtained Of the total of nearly 42,000,000 lb. estimated as the output in 1915 quite 30,000,000 lb. is put down as having come from the Consolidated Co's Sullivan mine, in Fort Steele division of East Kootenay.

Slocan mines do not seem to have made anything like so good a showing as in other years, their total for 1915, estimated at about 7,000,000 lb., being, seemingly, less than one-half of that of either 1914 or 1912 and than one-third that of 1913. The surprise mine appears to have made the biggest production of lead in the district last year, estimated at between 1,600,000 and 1,700,000 lb., with the Rambler-Cariboo next as regards quantity; probably the Slocan Star and the Standard exceeded 1,000,000 lb. each, with the Hewitt-Lorna Doone mines of The Silverton Mines, Ltd. next with more than 500,000 lb. and the Ruth-Hope between 400,000 and 500,000 lb. Among at least a dozen smaller producers, the Wonderful produced most lead, next there was the Lucky Thought, and then the Wakefield and the Galena Farm, which last-mentioned mine only commenced production in November after having been closed for many years.

More than one-half of the estimated production of Ainsworth division is thought to have come from the Bluebell mine, but no returns were received, so this is a suggestion based on consideration of the average lead content of known earlier shipments of lead concentrate. About one-fourth of the Ainsworth total is regarded as having come from the Cork-Province mine; then come the Utica, No. 1, Early Bird, and Retallack & Co.

Nearly 1,000,000 lb. of lead came from the Emerald mine, near Salmo, Nelson mining division, and very much smaller quantities from three other mines in the same neighborhood.

Mines near New Hazelton in Skeena district, others near Ferguson in Trout Lake division, and the Monarch in Northeast Kootenay were also producers of lead, though not in large quantity last year.

Copper. The most striking thing in connection with the year's production of copper was that of a total output of about 57,500,000 lb., nearly 35,000,000 lb. was from Coast districts which, prior to 1914 had always been the chief sources of copper production in the province. In 1914 the Coast district had a total of 24,000,000 lb. against that of the Interior of 21,000,000 lb., but in 1915 the increase of the Interior was only 2,000,000 lb., while that of the Coast was 11,000,000 lb. The consequence is that the Coast district is now far ahead of the Interior in the matter of present production of copper, and the prospects are that it will hereafter considerably increase its lead in this direction. The Granby Consolidated Co's Hidden Creek mine, near Observatory inlet, in 1915, made an output of little less than 662,000 tons of ore from which rather more than 21,800,000 lb. of copper was recovered. The Rocher Deboule Copper Co's mine shipped to Anyox 14,500 tons of ore that is estimated to have yielded a total of nearly 2,200,000 lb. of copper. The output of the Skeena country, therefore, was about 24,000,000. The Britannia mine, in Vancouver mining division, produced approximately 10,000,000 lb. and the Marble Bay mine, Texada island, may be credited with well on for 1,000,000 lb. These several amounts together make up the 35,000,000 lb. estimated as the copper production of the Coast district in 1915.

In Boundary district, the Granby Co.'s output from 1,035,000 tons of ore was about 16,046,000 lb. of copper; the British Columbia Copper Co. produced 1,470,000 lb. The production of Rossland mines is estimated to have been 4,700,000 to 4,800,000 lb., that of Kamloops and Nelson between them nearly 200,000 lb. Rossland and Boundary each made an increase of not less than 1,000,000 lb. over their respective totals for 1914.

Zinc. While the total output of zinc is believed to have been not less than 11,940,000 lb., it is thought likely final returns will show this to be somewhat less than the actual production. Nearly all zinc figures are estimates, few returns having been received from shippers, though information from other sources warrants the conclusion that production was about as here stated. Zinc occurs in association with lead in the ores mined at the Bluebell, Cork-Province, and Utica mines, in Ainsworth division, but no account of these has been taken in making up the estimate, although it is known that some zinc ore was shipped from the Utica. Retallack & Co's mines at Whitewater are taken to have shipped ore that yielded 600,000 to 700,000 lb. Slocan mines from which zinc may be expected to be produced in larger quantity in 1916 than in 1915 are the Galena Farm (the concentrating mill at which was started late last year), Hewitt-Lorna Doone, Lucky Jim, Rambler-Cariboo, Ruth-Hope, Slocan Star, Standard, and Surprise with others in course of development that will probably add to the total production now that, through the enterprise of Mr. J. P. Keane, a custom concentrator is being operated in the neighborhood of Rosebery, Slocan lake. Approximate figures of production in 1915 from Slocan mines are—from the Standard mine 4,000,000 lb., the Surprise between 2,000,000 and 2,500,000 lb., and about 3,500,000 lb. as the total from the Galena Farm, Lucky Jim, Silverton Mines, Ltd. (Hewitt-Lorna Doone), Rambler-Cariboo, and Slocan Star. There is one fact that will tell in favor of 1916 to the disadvantage of 1915, namely, that there was last year much zinc product stored at Slocan mines awaiting sale that for this reason was not included in the production of the year, yet which is either now being shipped to the United States or will shortly be, and so will do to swell the total of production to be credited to 1916. One instance may be mentioned here; the zinc in concentrate stored at the Slocan Star mill has been variously estimated at from 10,000,000 lb. upward and late in the year this was sold, but, of course delivery will be in 1916, consequently this year will have the benefit of what was actually last year's production to the extent indicated.

Zinc carbonate ore was shipped from the H. B. mine, on Deer Creek, about ten miles from Salmo, in Nelson mining division, in quantity sufficient to make it appear that a production of between 1,000,000 and 1,500,000 lb. of zinc was made there. Then shipments of zinc ore from the Monarch mine, in Northeast Kootenay are reported to have been in large enough quantity to suggest an output of more than half a million pounds of zinc. From these two sources, then, there seems to have been a total output of approximately 2,000,000 lb. of zinc. So far as known, there was not any commercial production of zinc elsewhere in the province.

Other Metals. Some antimony ore was taken to Three Forks, Slocan, from the Alps-Alturus claims, situated high up on a mountain above a creek tributary to the north fork of Carpenter Creek. One carload was shipped to England, but there has been a long delay in receiving returns. A second carload has quite recently been reported to have been shipped to Chicago. Years ago a test shipment from the same property was made to Trail, but the value of the mineral at that time was too low to make mining the ore profitable.

Iron occurrences in the province do not appear to have been further developed in 1915, nor was there any commercial production of the ore reported. Molybdenum was

talked about and some newspaper statements concerning it made pleasant reading, but there was no production worth mentioning. A little platinum was recovered with gold on Tulameen river and tributary creeks; a statement made last October in the district to the writer was in effect that a branch bank at Princeton had during the season purchased more than $1000 worth of platinum from Tulameen placer-miners.

Coal and Coke. An estimate made in December placed the gross production of coal at 2,060,804 long tons. In January corrected figures were received from one of the sources of information, with the cheerful intimation that "a mistake of 100,000 tons was made in the figures sent earlier." Accordingly the earlier estimate was that much out, gross production having been 1,960,804 tons, as now estimated. The exact production is not yet known, but it will be found to be about the quantity last above stated. Deducting 408,804 as the approximate quantity made into coke, a net production of 1,552,000 long tons may be regarded as close to what the official revised figures will be when arrived at later.

The net production of Vancouver Island mines is now estimated at 955,940 tons, as follows:—Western Fuel Co's mines, 411,470 tons; Canadian Collieries, Ltd's mines, 370,936 tons; Pacific Coast Coal Co's mines, 127,500 tons; Vancouver-Nanaimo Co's mine, 46,034. Nicola Valley mines produced 88,385 tons, of which 54,500 tons was from the Middlesboro colliery, 32,820 tons from the mine of the Inland Coal and Coke Co., and 1065 tons from that of the Pacific Coast Colliery Co. In Similkameen district, the Priceton Coal and Land Co. produced 12,675 tons. East Kootenay's net production is placed at 495,000 tons, of which 52,955 tons was from the Corbin Coal and Coke Co's mines and 442,045 tons from those of the Crow's Nest Pass Coal Co. In addition, the last-mentioned company made about 355,000 tons into coke.

Coke production is estimated at 248,424 long tons, of which 239,178 tons was made at the ovens of the Crow's Nest Pass Coal Co. at Fernie and Michel, and 9,246 tons at those of the Canadian Collieries (Dunsmuir) Ltd., at Union Bay, Vancouver Is and.

Structural Materials. The value of building and other structural materials constitutes by far the largest part of the amount shown as an estimate for "miscellaneous products." No details are yet available, but taking the proportions of the 1914 production of such materials as a guide, it may be assumed that of the $2,000,000 estimated as the total value for 1915, fully 30 per cent, was that of portland cement manufactured in the province, 15 per cent. that of clay products, a similar percentage for sand and gravel, five per cent. for lime and limestone and the remaining 35 per cent. for building and other stone and rock.

Other Minerals. Mica occurs in the northern part of Revelstoke mining division, oil in the extreme south-eastern part of Kootenay district, and some others of those usually included in mineral production, but there was not any commercial production of these in British Columbia in 1915.

McINTYRE-PORCUPINE MINES

Under date of January 18, President A. M. Hay, gave out the following information to shareholders of McIntyre-Porcupine Mines Ltd:

Production and development operations for the quarter ended 31st Dec., 1915, were as follows:—Tons Milled 26,160; Value per ton $7.39; Gross value $193,261; Recovery $184,233—95.42%; Operating cost $108,748—$4.16 per ton; Operating profit $75,485.

At No. 4 Shaft on the south side of the lake there have been no recent developments of importance in the workings which continue to give a steady production of milling ore This shaft, which is now 600 ft. deep, will be sunk to a greater depth in the near future. During the period there have been several important developments in the workings at No. 5 shaft which has been sunk to a depth of 700 feet. Some extensive ore bodies have been located and are now being opened up on various levels. On the fourth level a vein 15ft. wide assaying $8.00 per ton has been cut to the north of No. 5 vein and is either a new vein or an extension of No. 5, on which a large body of ore had already been opened up on this level. On the fifth level No. 5 vein in west drift is at present 25ft. wide, with an average value of over $10.00 per ton. The continuation of this vein to the east of the cross-cut has been picked up where a fault was encountered displacing the ore about six feet. On the sixth level a cross-cut is being run to the north to intersect a vein recently cut by diamond drilling from the station on that level. No development work has yet been attempted on the seventh level owing to the present inadequate hoisting facilities, which will, however, shortly be improved. By diamond drilling from this level at an angle of 37 degrees, an orebody has been cut at a vertical depth of about 750 ft. from the surface, nineteen feet in width and showing by assays an average value of over $18.00 per ton.

McIntyre Extension. This shaft is now down 985 ft., and will be continued to a depth of 1060 ft., in order to make provision for an ore pocket and sump. A cross-cut will be driven at the 1000 ft. level towards the McIntyre No. 5 shaft. This work will explore the ground between the two shafts and enable the workings of the two properties to be connected up for more economical operation. It should also intersect at that depth the ore bodies above referred to on the McIntyre property to the north of No. 5 shaft, which will be development work of very great importance.

McIntyre-Jupiter. The raise has been completed from the 300 to the 200 ft. level at No. 1 B shaft which will be used as a working shaft for the present. A new head frame embracing a crushing and sampling plant is being installed and the new compressor plant and mining equipment has been shipped and should shortly be on the ground. It is expected that active mining operations will be commenced by the time that the McIntyre new mill-unit is ready to receive and treat ore from this property.

Mill Construction. The extension to the mill building has been completed, but serious delays have been met with in the shipment of most of the material. Cyanide tanks are now in place, and most of the mechanism and piping has been installed. The tube mill is now in transit and shipment of the ball mill has been promised within a few days. It is expected that the new unit will be ready to operate about the middle of February, when the total capacity of the mill will be 450 tons per day. The increased milling capacity and the higher values to be expected from the ore bodies being developed on the lower levels should greatly increase the company's earnings during the present year.

In order to embrace a full period of twelve months from the date of the last Report and Balance Sheet issued to Shareholders, the Fiscal Year of the Company will be closed on the 31st March next, and the Annual General Meeting of Shareholders will be held in May.

DUPONT

Wilmington, Del.—Alfred I. du Pont, the deposed former vice-president of E. I. du Pont de Nemours & Co. and his associates have sent telegrams to the company's stockholders asking them not to send proxies for the annual meeting and election to President P. S. du Pont and other officers until a court decision has been made on the suit between the two factions that is now on trial.

INVESTIGATION OF BITUMINOUS SANDS IN NORTHERN ALBERTA

By S. V. Ells*

Since the advent of the fur traders during the eighteenth century, deposits of bituminous sand (heretofore referred to as "tar sand") have been recognized in Northern Alberta. These deposits are probably the largest of the kind in the world, yet, until recently, practically nothing has been known regarding their true economic importance.

In 1913 a brief reconnaissance of the deposits was made, during which upwards of two hundred and fifty individual outcrops were measured, and over 100 samples secured.

Following this preliminary examination, the writer suggested that a section of experimental pavement be laid. It was felt that such a pavement would illustrate in a practical manner the value that should attach to the Alberta deposits as a possible source of a suitable paving material. During 1914, a quantity of the bituminous sand was, therefore, mined and shipped to Edmonton. During the past season, this material was laid as a pavement in Edmonton. This pavement comprised sections of three types of surfacing, viz., sheet asphalt, bitulithic and bituminous concrete.

As a site for this pavement, a section of Kinnaird Street, immediately south of Alberta Avenue, was selected. The traffic along this part of Kinnaird Street is such as will give a pavement a fairly severe test, and may be classed as heavy. Apart from a considerable volume of fast automobile travel, it includes vehicles which carry loads up to eight and ten tons.

Deposits of bituminous sand in Northern Alberta may be grouped in two classes, viz.:—(1) Deposits in which bitumen is combined with a coarse mineral aggregate; (2) Deposits in which bitumen is combined with a fine mineral aggregate.

The trial shipment used in the construction of the Edmonton pavement comprised both fine grained and coarse grained varieties, and, from a consideration of analyses of the crude material, three outstanding features were at once apparent:—(1) High penetration of asphalt cement; (2) Unbalanced mineral aggregates; (3) Excess of asphalt cement, (15%).

The effect of unduly high penetration was modified by partial distillation of the more volatile fractions. The unbalanced aggregates of coarse and fine bituminous sand were partially corrected by combining the two in a proportion of two of fine to one of coarse. In the case of the sheet asphalt mix, the resulting aggregate was further modified by the addition of clean and graded sand; in the case of the bitulithic mix, by the addition of clean sand and graded crushed gravel. In the case of the bituminous concrete, fine grained bituminous sand only was used, and was modified by the addition of graded crushed gravel and of clean sand. This manipulation also reduced the somewhat high percentage of asphalt cement present in the original material to the final percentage desired in each case.

In heating and mixing the materials, a heated rotary mixer was used. This mixer consists essentially of a revolving, jacketted drum, set on trunnions above a firebox, and connected to the engine by shafting and gears. The inner surface of the mixer drum is fitted with baffles so arranged that a thorough mixing of charged materials is assured. Convenient charging and dumping facilities are provided.

In actual operation, and prior to charging, the drum was usually preheated to a temperature of 250°-300° F. The bituminous sand was then wheeled in barrows to the loading platform, and the drum charged. During the first period of heating, the drum was kept closed by means of a damper. When, however, the bituminous sand had reached the desired temperature (400°-410° F) the heat was turned off, and the damper removed. The mix was then allowed to remain in the drum for a further period of 8 to 10 minutes, during which time the lighter hydrocarbons passed off freely as vapor.


Experimental pavement at Edmonton, laid under direction of S. V. Ells, of the Mines Branch, to demonstrate use of Alberta's bituminous sand deposits.

Analyses of samples of the finished pavement indicate some room for improvement in the balancing of the mineral aggregate. In this respect, however, there should be no real difficulty in making desired modifications. The penetration of the asphalt cement is high. With a properly balanced aggregate this does not necessarily indicate a source of weakness.

The wearing surface mixture reached the street at an average temperature of 325° F., though the temperature of occasional loads was 350° F. It was immediately spread on the 6″ concrete base with hot shovels and hot rakes.

Owing to the somewhat light nature of the contained asphalt cement, it was found necessary to exercise care in rolling. The best results were obtained by first rolling with a light (15 lbs. per linear inch width of tire) hand

*Mines Branch, Ottawa.

roller almost immediately after the wearing surface mixture had been spread. As soon as the temperature permitted—usually within three hours—a small quantity of Portland cement was sprinkled, and the surface thoroughly compacted by means of a 7-ton roller (250 lbs. per linear inch width of tire).

In the case of the bituminous concrete and bitulithic, the usual flush coat, with $\frac{1}{4}''$ stone screenings, was spread upon the surface, and all superficial voids filled.

The experimental pavement referred to above was opened to traffic on August 26th, 1915, and up to the present time, (December 20th), is in a satisfactory condition. It is obviously quite possible that defects may develop in this initial work with new and untried materials. in considering past attempts, the writer considers t at under favorable conditions, commercial extraction as applied to the McMurray deposits will be found practicable. Further, it should be remembered that, owing to freight and other charges on imported asphalts, extraction in Alberta would be on a much more favorable basis than has, for example, been the case in California where competing residuum can be sold at a very low figure.

It is of importance to note that, in December, 1915, grading along the Alberta and Great Waterways Railway was practically completed as far as the proposed terminus at McMurray townsite. In descending into the Clearwater valley near McMurray, railway cuttings have been made at three points in the bituminous sand itself. Within a radius of one mile of the terminus of the road, a number of other outcrops are readily accessible. It is expected that track laying and ballasting will be completed during the winter and summer of 1916. The distance from Edmonton to McMurray over the new railroad will be approximately 305 miles.

Example of topographic maps recently completed by S. C. Ells, illustrating typical mode of occurrence of bituminous sand deposits in Northern Alberta. All streams tributary to the Athabaska riverin the McMurray district have been mapped in this manner. The maps were originally drawn on a scale of 1 inch equals 400 feet, but have been reduced to the present scale of 1 inch equals 1000 feet.

Outcrops of bituminous sand are almost altogether confined to slopes of older valleys, and to cut banks along present water courses. Elsewhere the surface of the country is level, and represents a plain.

On the maps, outcrops of bituminous sand are indicated to scale, at certain points. It should however, be remembered that these outcrops represent a single deposit which is practically continuous throughout the whole area.

Nevertheless, there are strong indications that, with minor modifications in manipulation, Alberta bituminous sand can be successfully adopted as a basis for satisfactory asphaltic pavements.

From a comparative study of cost data based on the use of Alberta bituminous sand and of imported asphalts, it appears that the application of the former in the crude state will be restricted within comparatively narrow limits in Western Canada. Indeed, extensive development of the McMurray deposits will probably depend on the commercial application of an extraction process whereby the bitumen can be marketed in a more or less pure form. Such a process would doubtless ensure for the McMurray product a wide market, not only as a paving material, but in many other recognized applications for high grade bitumen.

At various places in the United States during the past twenty-five years, the commercial extraction of bitumen from bituminous sands and sandstones has been attempted. Owing to various recognized causes, none of these attempts have met with commercial success. Nevertheless, in view of the various factors that must be taken into account

In a pamphlet recently prepared by the writer, reference was made to the occurrence in the McMurray district of certain of the higher grade clays. In addition to deposits there noted, samples secured during the past season indicate the presence of stoneware clay, suitable for the manufacture of pottery, such as jugs and crocks, or for sewer pipe.

During the past season, topographical mapping of the area underlaid by bituminous sand was also carried on. On this map are shown extent and position of individual outcrops, as well as thickness and extent of overburden. The map also indicates those areas which may most advantageously be developed, and will serve as a basis for an approximate estimate of the total tonnage of bituminous sand available.

SURF INLET GOLD MINE

"The Province", Vancouver, printed the following in its issue of Jan 1:

With the payment of $150,000 to the Surf Inlet Company of this city by the Tonopah-Belmont Company of Philadelphia, ownership in one of the great gold mines of the province passed from Vancouver hands to mining men from across the line. Mr. Fred M. Wells, the mining engineer who first realized the potential possibilities of the Surf Inlet as a gold producer, and who put in four years of his life developing the property before it was taken over by the Philadelphia company, is in the city to-day. He states that while he will participate in the first payment along with the other large stockholders in The Surf Inlet Company, he likes the clause which allows the original company a one fifth interest in the property, irrespective of the sale.

The option which the Tonopah-Belmont Company held expired to-day but the cash payment of $150,000 was paid to-day, guaranteeing to the public the real success of the enterprise.

The camp was first developed by Victoria men and although they sold out at an early date and probably without reaping the fullest reward for such pioneer work, still it will give them satisfaction to know that through their efforts a gold camp of great promise has resulted.

Closely following the Victoria men's operations, Mr. E.A. Cleveland of this city became interested and made a serious and well-directed effort to develop what is now the Surf Inlet mine, but through the failure of adjacent properties the camp was given such a black eye that it became impossible to secure necessary capital and operations on his property were also closed. While it has been a long wait for Mr. Cleveland, the results of his early mining venture have been very profitable, for aside from the good cash figure which he has already received, he is one of the heaviest holders of shares in the present Surf Inlet Company.

During the early development of the camp the ore was mined and packed to salt water on horses and shipped to the smelter for treatment. Although the ore contained good gold values the cost of handling was so great that it resulted in a loss and discouragement and finally closing down the works.

After lying idle for several years the camp was brought to the attention of Fred M. Wells and A. B. Clabon and resulted in Mr. Wells making a trip to the camp and thoroughly examining several of the properties. Mr. Wells was very favorably impressed with the possibilities of the mines and in the interest of himself and Mr. Clabon secured an option on the group, known as the "D. L. S." group and owned by Mr. E. A. Cleveland of the firm of Cleveland & Cameron of this city. With the object of developing the property a company was formed, composed of local Vancouver business men and known as the "Surf Inlet Gold Mines Limited."

The development of the mine was placed in the hands of Mr. Wells and during the following four years about $100,000. was expended. The result of this work was to prove the ore to a depth of about 500 feet and a continuous length of several hundred feet along the vein, demonstrating its value and size to that depth.

Realizing the necessity of still further development and the building of a milling plant, involving large capital, the local company decided to be relieved of this responsibility and gave an option to the Tonopah Belmont Development Company of Philadelphia. This company is made up of a group of wealthy Philadelphia men with Mr. Clyde A. Heller as president. They own and operate some very large mines, including the noted Tonopah-Belmont mines of Tonopah, Nev., and have been most conspicuous by their successful operations.

Work on the option began about May 1, 1914. The equipment at the mine necessary for the work consists of a power plant of two 50-horsepower boilers, a ten-drill compressor, an electric plant for lighting, blower for ventilation, small hoist, etc.

As the mine is 6 miles from salt water, roads had to be constructed, gasoline boats put on the lakes, besides the fine ocean-going power cruiser "Full Moon," purchased from Mr. Knox Walkem of this city, to assure communication at all times with the outside.

All operations at the mine were placed in the hands of Mr. F. W. Heller, mining engineer. A working force of about 50 men have been engaged up to date. A very complete set of buildings were erected, consisting of comfortable bunkhouses, cook and dining houses, powerhouse, blacksmith's shops, office building, assay office and cottages for men, forming in all quite a neat group of buildings, which, when brightly illuminated with electric lights, reminds one of some of the old-time gold mining days of other camps.

Up to the present the company has done about 6000 feet of development. While some work was done in the upper workings the greater part consisted of opening up a new level by a tunnel nearly 3000 feet in length, which cuts the ore body about 500 feet below the old workings, and nearly 1000 feet from the surface. The orebody was encountered on the low level in July, and since that time several hundred feet of ore has been developed, which, from its great size and high values will soon make the mine famous by its production of gold bullion.

Development work will continue on the mine, and a large mill will be built at once, together with development of a hydro-electric power plant for operation of mine and mill.

"While the Tonopah people are to be congratulated on the success of their first business undertaking in British Columbia," said Mr. Wells this morning, "we are glad to say the Vancouver owners who first developed the property hold an enviable place in the future of the mine, for besides the cash received, the Surf Inlet Company retain a fifth share in the future profits of the mine.

"The successful development of the Surf Inlet mine, solely by local business men, is a real object lesson for the people of this city to think about. Situated as we are in the centre of a great undeveloped mining country, there is no reason why a fair portion of the money available for new enterprises should not be devoted to the development of our own mines. Especially does this idea apply to the initial development of prospects. Like all other classes of business it is essential that experience and good judgment guide the operations."

The directors of the Surf Inlet Gold Mines Limited are Col. J. Duff-Stuart, president; E. A. Cleveland, vice-president; A. H. Wallbridge, treasurer; A. H. MacNeill, K.C., Jonathan Rogers, W. B. Burnett, M.D. and B. G. Hawkins, secretary.

MAXIM MUNITIONS.

New Haven, Jan. 21—Maxims Munitions Co. plant here will resume operations on Friday of this week. Installation of machinery from one of the company's plants in Derby occasioned the temporary cessation of work in the main plant here.

The corporation expects to receive a part of the big contract from the Russian Buying Commission for machine guns.

Engineers are making plans for the erection of a new building close by the main plant where company expects to turn out ammunition.

CORE DRILLING AT THE HOLLINGER

By Albert M. Brown

The rapid growth of the Northern Ontario gold mines has formed one of the sensational features of mining history in the past few years. One of the most interesting and successful of these properties is the Hollinger Gold Mines, Ltd., of Timmins, Ont., Canada. Starting operations in 1911 by milling 1,000 tons of ore, valued at $46,082.00, it has jumped ahead, until, during the year 1914, 208,936 tons of ore was milled, carrying a valuation of $2,688,354.00. Up to July 1, 1915, the total dividends paid by the company have amounted to $3,600,000.00.

Core Drilling at the Hollinger Mine

The use of core drills has been of great assistance to the management in carrying on the rapid development of the property; and several ore bodies which had been missed by the ordinary methods of cross-cutting have been subsequently located by diamond drilling.

The company carries on diamond drilling underground as a regular part of the routine work. Vein walls are prospected for branch veins by means of series of short horizontal holes, and extensions to veins which appear to have pinched out are sought for by similar means. Up to October 7, 1915, 21,344 feet of core drilling has been performed at the property.

For assistance in determining the best method of development, four Sullivan diamond drills are employed. Two of these are class "S," having a capacity of 700 feet in depth and removing a 15/16 inch core. A third is a class "E" machine, mounted on jack screws and employed in the narrow stopes for testing the various pockets of ore, which often occur on the main vein. The "E" drill takes out a core 15/16 of an inch in diameter and will drill to a depth of 500 feet. Owing to its light weight and the fact that it may be dismantled if desired, it is easily pulled up into the high, narrow stopes and there set up.

Sullivan "E" Core Drill in a Drift at Hollinger Mine

The "S" drills are of small size and compact, especially adapted to work in drifts where space is limited. The drill rods and core barrels on all these machines are five feet long, permitting operation in cramped space without the necessity of cutting a station to operate the drill. The underground machines are run by compressed air.

The Hollinger Company, in addition to its underground drilling, has undertaking to determine the extent of its

Sullivan "B" Core Drill at Hollinger Mine

veins at depth, and for this purpose during the past year employed a Sullivan class "B" diamond core drill having a rated capacity of 3,200 feet. This drill removes a core 1⅝ inches in diameter and uses 10 foot drill rods. It is operated by compressed air.

The hole was started across the property at an angle of 60 degrees from horizontal. It was bored to a depth, measured along the drill hole, of 2,000 feet, the vertical depth at this point being 1,425 feet. The angle of the hole flattened as its depth increased, so that at its final depth it was advancing at an angle of 45 degrees with the surface. The total variation in the 2,000 feet was therefore 15 degrees. The tendency of angle holes to rise is well known and was allowed for by the management.

The 2,000-foot hole was put down in a little less than three months. The average run, working two twelve-hour shifts per day, was 40 feet in 24 hours. The longest run in a single day was 55 feet. A tripod 50 feet in height was erected over the drill hole and the rods were hoisted in 30-foot sections, so as to save time in hoisting and lowering. Due to the use of this high tripod, it was also possible to substitute a 20-foot double tube core barrel for the ordinary 10-foot barrel. By the use of this special core barrel, which consists of two barrels in reality, one being an inner casing on ball bearings to protect the core from the wash-water and the jar of drilling, from 85 to 90 per cent of the core was recovered from the hole.

The "B" diamond drill is equipped with a Sullivan single cyclinder hydraulic feed, an important feature in deep drilling such as this, as it is very sensitive, permitting the operator to adjust the feed accurately to the formation of the ground, which in this vicinity is very broken and variable. The country rock, through which the drill passed in the work, was a soft schist, whereas the vein material was the gold bearing quartz, very hard in comparison. The hoisting gears are proportioned for a heavy line of rods, the drum making one revolution to 39 of the engine. For shallower holes and lighter loads, direct gearing in the ratio of one to 13 permits a more rapid hoisting speed. One revolution of the drum winds up about six feet of the rope.

PORCUPINE AND COBALT DIVIDENDS IN 1916.

Under date of January 26, the "Toronto World" which has lately been devoting considerable space to mining news, prints the following comments written by Mr. Dick Pearce:

How long it will take the gold mines of northern Ontario to pass the annual dividend record of the silver mines is a question that is causing considerable interest in mining circles.

Cobalt mines paid up to the end of last year over sixty millions in dividends—to be exact, $62,100,827. This record dates from the first year of operation, as it does not take long to get a property in shape for shipping the white metal. Dividends last year of silver companies totaled $4,289,039 and gold companies $2,277,187.

Twenty-five incorporated companies have paid dividends out of Cobalt, while private corporations accounted for $3,825,000 out of the total. Last year twelve companies paid dividends, and bonuses of private corporations amounted to $175,000. The Nipissing mine has paid $13,840-000 in dividends or about as much as the next two companies on the list.

Ten companies have paid back their capitalization. The Hudson Bay has paid its capitalization back 250 times. The Beaver has paid 295 per cent.; Buffalo, 282 per cent.; Nipissing, 224 per cent.; Crown Reserve, 196 per cent.; Seneca-Superior, 205 per cent.; McKinley-Darragh, 205 per cent.; Kerr Lake, 199 per cent.; Coniagas, 196 per cent., and Trethewey, 108 per cent.

The highest dividend payer last year was the Seneca-Superior with 70 per cent. Nipissing was next with 20 per cent., followed by Coniagas with 15 per cent.

So far only one Porcupine company, the Hollinger, is paying back its capital. The total disbursement to the end of 1915 was 139 per cent., involving $4,170,000. The Hollinger is now on a dividend basis of 52 per cent. per annum, or $1,560,000. The Hollinger was the largest dividend payer last year among the gold and silver mines, Nipissing following with a disbursement of $1,200,000.

The Dome started on a 20 per cent. basis last year and paid a half yearly dividend of 15 per cent. amounting to $400,000. This year's disbursement will be $800,000 and it is possible that a bonus bringing disbursements well over the million mark may be made. The Dome last year milled 317,873 tons of ore, recovering $1,307,322 in gold. This year the production will be greatly increased.

The Porcupine Crown paid 12 per cent. last year and it is unlikely that any change will be made, The mine runs along smoothly, steadily producing gold.

The Tough-Oakes mine was put on a 10 per cent. basis last year. Only one-quarter yearly dividend was paid in 1915. The second was paid this month. The Tough-Oakes is the first gold mine in northern Ontario outside of the Porcupine district to pay dividends. On a 10 per cent. basis the 1916 disbursements will be over $260,000.

Col. Hay stated to The World representative that if developments at the mine continue, McIntyre will be on a dividend paying basis this year. McIntyre's attention has been given to making the property into a big mine rather than paying dividends. In the long run this will be a good thing for the company, as it places it in a position to mine advantageously.

Without counting in the possibility of a dividend from McIntyre the gold mines of northern Ontario will pay close to three million dollars in dividends during 1916. Added to this the probabilities of increased dividends by the gold mines are well worth taking into consideration.

On the other hand, Cobalt is a problem. It is doubtful if 15 companies will pay dividends this year, but some will increase.

On the whole it would almost be safe to say that Cobalt dividends would decrease in 1916 while the gold mines will make increased disbursements.

L. S. IRON ORE TRADE.

Iron Ore says; The Steel Corporation has made contracts with vessel interests for the carrying of iron ore from its Lake Superior mines for a period of five years a certain tonnage to be carried annually. As these contracts are made outside of its own big fleet they show that the big steel maker expects to have a big tonnage to handle in the years to come. It's a pretty favorable indication that business is expected in considerable quantity above the carrying capacity of the corporation's fleet of ships.

Vessel interests look forward to a fine business in the coming season of navigation on the Great Lakes. Contracts already made insure this, the advanced price for carrying ore over 1915 rates being 10 cents from the head of Lake Superior.

GERMAN INFLUENCE IN METAL MARKETS.

New York copper men believe that report from London that British government would shortly seek information about stock-holders and business connections of certain firms in the United States foreshadows an effort by England to wrest from Germany her powerful influence on metal markets of the world. Strength is given this belief by decision rendered a few days ago in Court of Appeals, London, in case dealing with the Australian zinc situation. Under this ruling precedent was given English holders of contracts to deliver ore to German refineries to break their agreement permanently.

THE BURNS CLAIMS SHAW TP.

Under date of Jan. 22, "The Porcupine Herald" prints the following extracts from two reports on the Burns' claims in Shaw township:

"These claims are situated in the south eastern part of the Township of Shaw, in the Porcupine Mining Division, District of Nipissing, Ontario. There are three claims, numbered 13890, 13891, and 900P. "The first two have been surveyed and contain about 40 acres each. 900P has not yet been surveyed but contains approximately thirty acres.

The claims in the winter are reached by sleigh road from Porcupine to what is known as the Hudson Bay Camp, a distance of 5 miles. From here there is a well beaten trail to Kings Landing on the Redstone River, a distance of four and a half miles.

"From here the trail runs up to Redstone for three miles, and then one and a half miles overland to the property. The end of sleigh road from Porcupine is four miles in a direct line from the property. Little development work has been done beyond stripping.

"The principal vein is of quartz impregnated with iron pyrite and showing occasional free gold. It has a strike slightly west of north, and has been traced pretty well through the two claims, 13890 and 13891. It runs through the centre of these claims. The average width is probably twelve feet and it has been stripped across in several places.

"A sample taken across 11 feet 4 inches gave an average of $13.85 in gold per ton. This sample was taken in sections and the values appear to be evenly distributed throughout the vein.

"Another vein is of quartz and is a foot in width. It runs parallel to the main vein and has been stripped for a couple of hundred feet and traced for that much more. Free gold shows here and there all along where it has been stripped. At one point a pit four or five feet deep has been sunk on it, and free gold shows in the bottom. This is the only point on this vein where any shots have been put in.

"Several other quartz veins, some carrying free gold are said to have been found on these claims, but owing to the deep snow we were unable to see them.

"The main shaft is a wide one and carries good values. The ore from a vein this size can be extracted cheaply, and the greater part of the gold is free. The vein is persistent in length, and if the values continue with depth, as they so far have done in this district, the property will undoubtedly make a mine."

Since the report was written development work has been done and a two stamp mill put in operation.

MILLER-INDEPENDENCE.

Timmins, Jan. 22—The last payment for the McDonough claims at Boston Creek has been made, and Mr. G. J. Miller has the deeds. Mr. Miller was in town on Saturday on his way to the Miracle Mine from Dayton, Ohio, and showed some beautiful samples of telluride and gold ore from the Miller-Independence mine.

The mill has been built under the supervision of Mr. Adams, late of the Dome staff, and another boiler went into the property last week.

The Dodge crusher is in place and milling operations will start shortly. The gold will be saved by amalgamation over 12 foot tables, and the concentrates will be shipped to the States.

About twenty men are now working at the mine and all the camps are built. Up to date six veins have been uncovered, but most of the work and the sinking is being done on the original veins which carry very high value.

The Miracle mine, of which Mr. Miller is also president, will start milling operations the latter part of February. A small gang of men have been working under Captain Ransome and some very good ore has been encountered at the 70 foot level.—Porcupine Herald.

GRANBY CONSOLIDATED

Boston—Granby Consolidated proposes to reduce par value of its shares from $100 to $25 and to issue four shares for one. It is believed the new shares will become more popular as trading units.

Granby originally had 1,350,000 shares of $10 par which several years ago were changed to 135,000 shares of $100 par.

Boston was the original trading centre for Granby shares and practically all transactions have taken place in this city, notwithstanding the fact that the company maintains its office in New York, its shares are listed there and its actual management is conducted from that city.

The year 1915 was a good one for Granby but as its fiscal year does not end until June 30, figures for a twelve-month will not be available until the coming fall.

As with all new plants, there were delays and disappointments encountered at the new property at Hidden Creek but recent results have been very satisfactory.

In December the new Anyox smelter treated 72,000 tons of ore, which was larger than expected, as the cold weather makes continuous operation very difficult in the winter months. The cost of producing copper at this plant is now $8\frac{1}{2}$ cents a pound, but with normal operations after the winter, an 8-cent cost is looked for.

Dividend requirements at the current rate of $6 per annum can be more than supplied from operations at the old Grand Forks plant where costs have been showing an advancing tendency. No better than 11 cents a pound can be hoped for at that property but so long as copper holds at or near its present high level this department of the company's operations can be made to give an excellent account of itself.

Granby is expected to increase its dividend before the end of its current fiscal year—probably during the second rather than in the first quarter of 1916.

A special meeting will soon be called to vote on reduction of par value.

GEOLOGICAL MAPS

We have received from the Geological Survey, Department of Mines, Ottawa, the following recently published maps, copies of which may be obtained on application to the Department.

Map 147A, Cranbrook, Kootenay District, B.C.

Map 142A, Field, Kootenay District, B.C.

Map 116A, Southwestern Ontario.

Map 111A, Vananda, Texada Island, B.C.

Map 110 A, Prescott, Paxton and Lake mines, Texada Island, B.C.

Map 41A, Duncan Sheet, Vancouver Island, B. C.

Diagram of city of Montreal and vicinity, showing location of artesian wells.

CROWN CHARTERED.

The "Porcupine Herald" hears on good authority that a syndicate has optioned the Crown Chartered mine, and that the Porphyry Hill property is optioned to the Northrup Syndicate until February 1st.

McAULAY-BRIDGE CLAIMS OPTIONED.

Timmins, Jan. 22—The McAulay-Bridge claims in Bristol have been optioned to Col. Hay, president of the McIntyre Porcupine Mines.

GERMANY AND THE METAL TRADES.

Opinion differs as to how far Germany will be able to stem and surmount the prejudices of the world when the war is over. Will she be shorn of many of her commercial and economic advantages or will she be able to recoup some of her present losses by trade aggression? Her grip upon the dye industry, her prominence in the realm of shipping and her dominance of the metal trades are among the strongest of her bulwarks threatened.

Complete readjustment of relations existing between German metal houses on one hand and mining and smelting corporations, largely British owned and controlled, on the other, looms forth as one of the results of the European war. The heretofore powerful influence of the Frankfort and Hamburg concerns may thereby be eliminated. Tangible steps along this line have already been taken by the British government and courts and the effect will ultimately be felt in the United States where these German houses have affiliations and through which copper in former years and zinc concentrates at the present time come to the United States.

Through its "trading with the enemy" bill Great Britain has been working out a plan whereby some of the largest London metal firms, which before the war were closely allied with German firms, could be placed under government supervision. The Court of Appeals in London has just rendered an important decision making possible the abrogation of contracts between English owned mines and German metal houses even after the end of the war.

Another step in this direction comes in the request of the British government for metal concerns in London to file specific data as to ownership, identity of clients and other pertinent business secrets. A year or more ago there was an investigation of some of the metal houses, notably Henry R. Merton & Co., one of the largest in the world. A list of stockholders indicated that a very large part of its shares, if not control itself, was held in Germany. The company had 25,000 outstanding preferred shares and ordinary 70,000 shares. The largest blocks were held by Germans, as shown below:

	Ordinary
Metalbank-Metallurgischegeselschaft	18,600
Metalgeselschaft	11,875
Schweizerischegeselschaft fur Metalwerke	11,875
Merton Metallurgical Co.	1,240

An appeal taken by Aron Hirsch & Sohn of Halberstadt, Germany from a lower court decision which nullified its contract with the Zinc Corporation resulted in an affirmation by the Court of Appeals in London of the lower court decision. Thus the Hirsch firm has lost the contract, which would not otherwise have expired until 1919, for concentrates produced by the Zinc Corporation, one of the largest Australian zinc properties. This contract called for a minimum of 85,000 tons and a maximum of 95,000 tons per annum.

The United Metals Selling Co., Phelps, Dodge & Co., and the American Smelting & Refining Co. have long maintained branches or agents abroad including offices in London. Control of these companies has always been held in the United States, there being absolutely none other than American ownership and management.—Boston News Bureau.

DOME EXTENSION

Timmins, Jan. 22—Capt. Anchor has returned to Porcupine and is now superintending the work preliminary to the re-opening of Dome Extension, and it is to be expected that new developments will be reported from the property itself within the course of the next fortnight.

Some of the most recent developments on the Big Dome point strongly to the probability that the big ore bodies of the Dome will be encountered on the Dome Extension.

CANADIAN SHELL MAKING

Gen. A. Bertram, president of the former shell committee of Canada, says in the Monetary Times: "The first order for shells from the English authorities was for 100,000 18-pounder empty shrapnel shells. It was a new venture for any Canadian manufacturing establishment and while the price of $8.55 per shell may appear high in light of to-day's experience, yet at about the same time an order for 1,000,000 18-pounder shrapnel shells was placed in the United States at $10 per shell. To the credit of Canadian manufacturers, they have completed 3,000,000 shells at average cost of $6.50 and the United States concerns have not yet completed their order and are asking extension of time.

"Total number of shells placed has been approximately 22,000,000; materials and quantities used: Steel, 800,000-000 pounds ; brass, including copper and zinc, 44,865,617 pounds; copper, 21,595,832 pounds; lead, 101,758,327 pounds; tin, 1,447,708 pounds; resin, 10,037,506 pounds; powder, 4,094,531 pounds; cordite, 9,649,990 pounds; nitrocellulose powder, 3,750,000 pounds; trinitrotoluene, 10,690,000 pounds.

"Monthly output of shells, 1,100,000; labor employed, approximately 80,000 to 90,000 men, including skilled and unskilled labor. There are also 1500 inspectors.

"As the business developed in Canada, as experience was gained, we were enabled to greatly reduce cost production, so much so that on our present contracts we expect to save the imperial exchequer probably $30,000,000 as between price of the original orders and prices now being paid manufacturers.

"One measure of satisfaction we shall always have—namely, one of the largest industries in America to-day, which will mean a productive output to the end of August of over $350,000,000.

THE MURDER OF AMERICAN MINING MEN.

At the meeting of the Board of Directors of the American Institute of Mining Engineers, Jan. 21, 1916, the following resolution was passed:

RESOLVED That this Board has learned with indignation and sorrow of the unprovoked and brutal murder of eighteen American citizens on January 10th, in the State of Chihuahua, Mexico, and laments especially the death of Messrs. C. R. Watson, C. A. Pringle, H. C. Hase and W. J. Wallace, who were members of the American Institute of Mining Engineers. As these men and their companions were engaged in the lawful prosecution of their work, we trust that nothing will be allowed to prevent or delay appropriate action by our Government concerning the outrage by which they lost their lives.

RESOLVED that the sincere sympathy of this Board and of all the members of the Institute is extended to the families and friends of Messrs. C. R. Watson, C. A. Pringle H. C. Hase and W. J. Wallace.

AND BE IT FURTHER RESOLVED that a copy of this resolution be sent to the Secretary of State of the United States, be published in the Institute Bulletin, in the press, and be sent to the families of the deceased members.

CANADIAN MINING INSTITUTE.

A meeting of the Toronto branch of the Canadian Mining Institute was held at the Engineers club, Saturday, Jan. 15. There was a lively discussion of the nickel question, many members taking part. The speakers expressed hopes that nickel refining in Canada will soon become a fact.

PERSONAL AND GENERAL

Mr. T. B. Williams, Engineer for The Canmore Coal Co. of Canmore, Alberta, has returned to the west after spending a month among his friends in Ontario.

Mr. A. A. Hassan has opened an office at 203-204 Riggs Building, Washington, D. C., for geological and mining engineering work. He has been prospecting with diamond drills gold deposits in Montgomery Co., Maryland.

Mr. J. B. Tyrrell has returned to Toronto from Porcupine and will sail on Feb. 9 for England.

Mr. Robert Bryce is at Sheridan, Montana, and expects to be there for a few months.

Mr. B. Neilly was in Toronto last week.

Mr. C. A. Foster of Haileybury has been in Toronto in connection with litigation over property at Kirkland lake and the arrangement of other matters which should result in increased activity in the mining districts along the T. & N. O. railway.

Mr. T. H. Rea is in Toronto. He is making headquarters in Chicago.

Mr. David Sloan formerly manager at the Rea mine was in Toronto last week.

Mr. G. C. Bateman is in Toronto.

Mr. T. W. Gibson and Dr. W. G. Miller, members of the Ontario Nickel Commission, have returned to Toronto after a visit to Cuba in connection with the nickel investigation.

Col. A. M. Hay, president of McIntyre-Porcupine mines, is at the property.

BOOK REVIEWS

Monetary Times Annual Statistical Review and outlook number. Edited by Fred W. Field, Published by Monetary Times Printing Co., Toronto. Price 50 cents.

This volume tells the story of an exceptionally interesting year in Canadian affairs. The great effects of the war on all industries and the ways in which Canadians have met the many new problems are set forth in an excellent series of articles by well known men. The larger part of the book is devoted to banking, bonds and investments, and insurance. Forty pages contain information classified under the heading "industrial," In these pages appears information concerning the mining industry. The Nova Scotia Steel and Coal Company is dealt with in a special article, and Mr. T. W. Gibson contributes some notes on nickel.

Heaton's Annual 1916—Commercial handbook of Canada and Boards of Trade Revenue. Published by Heaton's Agency, 32 Church St., Toronto.

This is the twelfth annual edition of a useful handbook. It enables one to find information which is not readily available, and buried in many diverse publications. The section headings are: official directory, correspondence, financial, commercial regulations, registration offices, credit reports, transportation, banking towns, customs, where to find it, towns and local opportunities, general information, agricultural districts and crown lands regulations, and tables.

A notable part of the book is the section "where to find it." This should prove a handy reference, enabling one easily to obtain information on diverse subjects.

INTERNATIONAL NICKEL.

New York, Jan. 25—In three months ended Dec. 31 last International Nickel Co. had a balance equivalent to about 7% on the common stock.

In the first nine months of the current fiscal year, after allowing all charges for depreciation, mineral exhaustion and preferred dividends, the company earned about 20% on the increased amount of common stock. Thus the full year's cash dividends were earned in nine months.

Gross earnings in the quarter ended with December were greater than any previous quarter in the company's history. It is expected the last half of the fiscal year will show gross earnings fully 50% in excess of gross for the first six months, with commensurate gain in balance for dividends.

Cash balance at close of fiscal year March 31, if no extra dividend is charged out in the meantime, will approximate 25% on the common stock. There is reason to believe that common shareholders will receive substantial extra cash dividend in the near future.

BOSTON CREEK.

Cobalt, Jan. 22—A new vein has been found on the property of the Miller Independence mine at Boston Creek. It strikes directly across the first discovery made. At one point where it has been uncovered there is a width of several feet of quartz, and in this quartz there is a good deal of free gold and suplhides. It is, moreover, not as flat an ore body as the first discovery.

A shaft is being sunk on the original discovery. Owing to the character of the ore body there has been some difficulty in following it. It has been in and out of the shaft once or twice already in the short distance to which the shaft has been sunk now.

A boiler has recently been taken in over the trail from Boston Creek, and, as a compressor and other equipment, including a small Nissen stamp mill purchased from the Dome, preceded it, the Miller Independence should soon be working under steam. The thick crust which formed on the snow last week made the breaking of roads quite difficult for some time, but the passage of the boiler over the trail from Boston Creek should make it quite good for the rest of the winter.

Some ore has already been bagged from the original discovery, and taken to an ore house which has been erected. —The Northern Miner.

ACCIDENT AT DOME MINE.

Timmins, Jan. 22—At five minutes to twelve 3 workmen lost their lives last night by a fall of muck on which they were standing in No. 3 shaft, precipitating them with the rock a distance of some 140 ft. to the 600 ft., level. The name of the deceased are: Mike Cahill, J. H. Smeltezr and Bernardin Deshais. Mike Cahill is well known in the camp since the early days and is an expert miner.

J. H. Smeltzer, whose wife lives in South Porcupine comes from Guelph, Ontario, and B. Deshais comes from Three Rivers and has a brother working at the Tough-Oakes mine. From enquiries it seems that the chute was hung up in the raise and a pipe driven into the pile was to be filled with powder to loosen it up. The end of the pipe had been battered up with hammerings and had just been sawn off when without any warning the mass fell to the bottom carrying the above deceased with it. H.Charette W. Asseltine, and H. Lajeunesse, were also on the edge not two feet away and had a narrow escape. Ah inquest will be held—Porcupine Herald.

SPECIAL CORRESPONDENCE

NEWFOUNDLAND

Copper. The first copper ore for the new smelter, has just been landed at the dock yards of the Reid Newfoundland Co. from the S. S. Newfoundland which ship arrived from Little Bay Mines early in the week. It is the first cargo of ore that has been shipped from these mines since 1900, when work was abandoned. This cargo of ore was taken from the dumps of which there are upward of ones hundred thousand tons lying on the surface and which can be handled very cheaply. Several tons of this ore in large pieces weighing from three to five hundred pounds is on exhibition at the dock yards and in some of the store windows along the street. One particularly large block of ore is exhibited in the window of Bishop & Sons. It weighs from three hundred to five hundred lb., and Mr. McKay, President of the smelting company informs us this piece alone is worth $75, and he says there are tens of thousands of tons of high grade copper ore in the dumps at the mines equally as good as the samples on exhibition.

The smelter is now about completed, and the work of smelting the ore will commence at once. The enterprise is being watched very closely by the mercantile and mining classes of the country, and on the success of this undertaking, which will be a good test of the smelting of ore by electrical process, will depend the introduction of a system of small smelters, which is so very much needed in Newfoundland to make mining a success. It is a system similar to this which has prevailed in the Western States, and has made mining the success it is in that country.

With the success which we have every reason to hope Mr. McKay's smelter will attain, there is every reason to expect that the Government of Newfoundland could be induced to erect a few small smelters in the mining districts and thus encourage an industry which has given so much wealth to the world. With a system of small smelters established throughout the country every man who owns a mining claim can go to work and develop same. It needs comparatively little capital to do this, and every pound of copper which he takes from his property, can be converted into cash at the smelters. In this way some hundreds of very valuable copper properties which are simply being retained from year to year by individual owners, by the paying of the necessary mineral fee to the Department of Agriculture & Mines, would be developed into very profitable industries, to the advancement of the country and the betterment of its people.

Coal Famine. A very serious problem faces Newfoundland this winter in the matter of a supply of coal for its people. The question has become most serious, so much so that the Government was obliged at the beginning of the year to commandeer every ton of coal within the city of St. John's. The shortage of supply is owing to no available shipping for this trade.

Newfoundland gets all her coal from Sydney, C. B., with the exception of an occasional cargo from the old country, and some hard coal from Philadelphia. In other years we had a fleet of Steel Ships (Sealing Ships) which brought all the coal that was needed, and in addition to what was required for the trade and domestic requirements large stocks were kept on hand to supply any foreign going ships, especially during the fall and winter months. On account of the war however, this magnificent fleet of steel ships (seven in all) were sold to the Russian Government to be used in the White Sea as icebreakers, and thereby Newfoundland was deprived of the shipping which gave her an assured supply of coal. When the New Year came in there was held in stock in this city only about 4000 tons of coal for all purposes, and this amount held by three coal merchants, others sold out completely during Christmas week. The price, which was $7.60 per ton for soft coals, before the end of the year, jumped to $10.80 per ton the second day of the New Year. It was then the Government stepped in and took charge of the supply, and instead of permitting the exorbitant price of $10.80 to be charged reduced the price to $8.00 per son. The coal merchants threatened not to import any more coal if they were restricted in their charges. Matters then became grave, so much so that the Government were obliged to look to the British Admiralty for a large collier to bring a few cargoes of coal from Sydney. At present no collier is available, but will be later on.

In the meantime the Government has succeeded in getting a large steamer—the S. S. Alconda from Harmsworths of England, which ship is due in Sydney about January 20th, and due here January 26th, with 6000 tons of coal. In addition the Government has also chartered a large steamer from New York and she will be engaged for several months in the coal trade and together with the help of the colliers to be loaned by the Admiralty a little later on, the fear of a coal famine will be averted.

In view of such a calamity as a coal famine being merely averted from the country, the matter of the development of Newfoundland's coal deposits, is a subject which should engage the very earliest and most careful consideration of the Government of Newfoundland and her people too. That Newfoundland should be depending on any country for a coal supply, when she has abundance of coal within her own bounds, shows negligence and utter disregard for the welfare and advancement of the country not on the part of any one particular Government but all of them, and the apparent indifference and apathy of those of our people who should have interested themselves before to-day in a matter of such vital importance to the colony. In an article which I am preparing for the next issue of the Canadian Mining Journal I hope to show from data in my possession and the reports and opinions of some of the best mining authorities, that Newfoundland in addition to possessing inexhaustible supplies of iron and copper ores has also vast deposits of coal. "Show me a Geological map of a country, said the great Dr. Buckland, and I can point out where its future prosperity lies, and where its manufacturing and kindred industries will be established." This applies particularly to the country that is fortunate to possess supplies of coal.

Iron Ore. Work on the iron mines at Bell Island is going ahead full speed. Full crews of men are employed night and day, and immense piles of ore are being stacked for early shipment, as soon as navigation opens.

PORCUPINE AND KIRKLAND LAKE

LaBelle. The steam plant at the LaBelle Kirkland Gold mines, at Goodfish is now running. It consists of a compressor which will run from six to seven drills; two 65 H.P. boilers and a big hoist. The shaft is now down to 130 feet and will be carried on without delay while a cross cut on the 100 foot level will be continued with all speed.

Premier. The Standard Porcupine Mine has been sold to a company called the Premier Gold Mining Company of Boston. The Standard has been closed down for a number of years. Recently it was purchased for a few thousand dollars from the liquidator by one of the principal shareholders. In the early days of the Porcupine camp, the Standard was one of the most spectacular surface discoveries outside the Dome, the Hollinger, and other well known properties. A plant was rushed in to the claim and set up and work carried on, on a considerable scale, though not with much intelligence. Some diamond drilling was done and a core containing a good

deal of free gold was found, but drifting underground was never successful in discovering where this core came from. The slump in the undeveloped Porcupine prospects came along and the Standard shut down and has been shut down ever since.

Lucky Cross. Several offers have been made for the Lucky Cross Mine at Swastika. One of these was by Col. Hay, and associates. At the time of writing no deal has been definitely closed although it is most likely to be finished at almost any time.

Apex. A meeting of the Apex Porcupine Mines will be held in Montreal next Monday. It will then be decided whether an offer of fifteen cents a share for a block of the company's stock will be accepted. In this case the property will be likely to start up soon.

West Dome. All financial arrangements to handle the further development of the West Dome have been completed, but it is most unlikely that anything will be done on the properties until much later in the year. At the present time the plant needs a great deal of overhauling and this can be carried out much more cheaply when the weather is milder.

Jupiter. The raise from the 200 to the 300 ft. level at the Jupiter mine has been completed and the new plant is now being installed. An ore-house is also being built. All the mine will be in good shape for active development by the time the additional unit of the McIntyre mill is ready to handle ore from this property.

McIntyre. The quarterly statement of the McIntyre Mine showed that for the period ending December 31st a profit of a little over $75,000 was made. It also stated that at the 750 foot level the diamond drill running at an angle of 37 degrees had cut an ore body fifteen feet wide of eighteen dollar ore. The shaft on the McIntyre Extension which is to serve as the main working shaft of the McIntyre group is now down to about 1000 feet. From the 1000 foot level cross cuts will be run to connect with the No. 5 shaft.

This cross cut should be instrumental in opening up several known veins on the McIntyre, while connecting the two properties. The completion of the addition to the McIntyre mill has been delayed owing to the non arrival of the tube and ball mills.

The tanks for the cyanide plant have been installed and it is expected that the whole of the new unit will be ready about the middle of February.

COBALT, GOWGANDA AND SOUTH LORRAIN

Temiskaming. The next annual report of the Temiskaming Mining Company will show that there has been mined during the year, about 1,600,000 ounces. Of this 280,000 ounces consist of ore broken on the stulls underground. The annual report will also show that despite the fact that most of the drills were running in development, costs were very low. This is the more remarkable since during all the time when silver was at such a low price drills were pulled off all veins showing ore and put on drifts that had either been abandoned by the old management or did not then show any ore.

There have recently been some very favorable developments in the mine. Drifting on the vein which has been yielding such remarkable ore, another high grade ore shoot has been encountered about 75 to 80 feet away. This is on the 500 foot level. Between the two points the vein yields a good width of milling ore. A very interesting, though so far not very profitable discovery has recently been made on the Gans claim on the 500 foot level. A body of quartz stretches clear across the face of the drift This quartz is for the most part almost barren but patches of high grade ore and smaltite occur in it, which make it profitable to hand pick and to run through the mill. The management of the Temiskaming decided that they would also sink their shaft through the diabase sill to the lower contact with Keewatin. Accordingly the shaft is now down 900 ft. and will be continued at the rate of about 100 ft. a month. Waste from this work is being used to back fill old stopes on the upper levels of the mine.

Beaver. The Beaver shaft is now down to 300 ft. where a station has been cut, and sinking has commenced again. The diamond drilling which was done about a year ago on the Beaver indicated that the Keewatin below the diabase sill would be found at about a depth of 700 ft. Progress is being made at the rate of about 100 ft. a month in sinking so that some information on this very interesting development should be forthcoming in May or June. The striking of ore in the Keewatin below the diabase sill would have revolutionary effects upon the Cobalt camp.

The Ophir Cobalt is now being pumped out and tenders are being asked for the sinking of the shaft from the 300 to the 600 ft. level. This will be the first work undertaken by the company in their new scheme of development.

The LaRose Mining Company is running a diamond drill from the 350 ft. level of the new shaft to discover the depth at which the Keewatin will be encountered. Discoveries on the Chambers-Ferland and the Nipissing adjoining make the subject very interesting to the LaRose. Last year the LaRose production was about 1,150,00 ounces. This is a good deal better than was anticipated last year, since no new ore bodies have been found. Profits amounted to about $225,000 for the year and expenses to about $405,000.

Power. All mines in the Cobalt camp have gone on a flat rate of $50 per H.P. since the beginning of the year. This arrangement has been made between the mining companies and the Northern Ontario Light and Power Company and it is considered to be a considerable reduction. Previously all kinds of rates were in vogue, running from $45 to $85 a H.P.; now they are all uniform.

The Genessee Mining Company has resumed work on the United States Claim, to the north of the East claim of the Chambers-Ferland. The shaft will be sunk to the 300 ft. level before any exploration work is undertaken.

The McKinley Darragh has commenced to sink a winze below the 250 ft. level on the Cobalt Lake fault. This is not the first time that the company has done work on the fault, but although a little ore has been found it has never been sufficient to pay expenses.

Copper from Cobalt. For the first time in its history, a copper shipment was made from Cobalt. This consisted of a car load of chalcopyrite ore from the Brewer and Price claim on the Montreal River, near Latchford. It was shipped by the Rand Syndicate to the States. The same syndicate is now working a copper prospect near the Sterling mine, a few miles west of mile post 76 on the T. & N. O. Railway.

The Crown Reserve Mining Company is sinking a winze on the large vein on the 500 ft. level. This vein was discovered some time ago, but the development was not rushed on it. Some patches of high grade ore have been found in it, but not sufficient to make it of paying grade. It is entirely in the Keewatin.

Trethewey. If the price of silver remains as high as it is to-day there is little doubt that the Trethewey will

commence work again, later in the Spring. There will be no hurry to start again, however, until the weather is moderate.

The South Bay Mining Company, working claims on Gowganda Lake is getting specifications and plans for the development of power at Gowganda. This scheme proposes the utilizing of the water of the East branch of the Montreal River. A tunnel will have to be bored for some distance from the East Branch to Gowganda Lake itself. Surveys are now being made and preliminary work undertaken. There are signs that Gowganda is not going to be so forsaken as it has been for the past two or three years. The Miller Lake O'Brien is working as usual and a fair body of milling ore has been found on the Millerett.

Barbara. On Wigwam Lake, the Barbara Silver Mines is setting up a plant. Mr. George Rogers has been in charge of the development of these claims for the past year and he has just returned from a trip to order machinery and other supplies in order to further develop the properties.

The Reeves-Dobie is now being worked by a Philadelphia Syndicate.

If the South Bay does persevere in its intention of putting in a power plant, it will undoubtedly induce many companies to resume.

COPPER.

New York—Developments in the copper market Friday Jan. 21, were sensational. Quotations for spot copper ranged above 25 cents a pound. One small lot of copper for February delivery sold as high as 30 cents a pound. This was an isolated case, and does not reflect actual market conditions. The large agencies made no sales above 25 cents, although opportunities presented would have enabled them to sell their product above that level.

It is the desire of the large producers to keep metal prices at a reasonable figure, and attempts to sell copper at what they regard as exorbitant prices will be discouraged.

With consumption running at a rate that has exhausted surplus stocks producers realize the seriousness of the situation, and their object is to stabilize conditions by holding prices at a level that will not discourage consumptive demand.

Boston, Jan. 24—Copper consumers were on the job early Saturday with telegrams and telephone communications with New York as a result of Friday's extravagant stories wired out from that city in relation to copper prices. There were sales Saturday for April shipment at 25¼ cents a pound.

An old-time boom in the copper shares is one of the predictions made during the present bull market that have not come true. And this is not at all due to a lack of bull ammunition. The copper industry gained great benefit through the war demand for metal while the rise in the shares has not been more than average. Where the trouble lies is puzzling a good many persons, but it is obvious that the public has never warmed up to the coppers. A feature of this situation is the attitude taken by the Boston market in coppers. New England speculators have shown no more indication of enthusiasm over the market in coppers than have people of New York.

A question constantly asked is, why doesn't Boston come in? Boston was the centre of former bull periods in the copper stocks—and also lost enormous sums in the last big boom. People with a first-hand knowledge of the industry consider the disparity between trade conditions and the stock market as past all understanding.

GENESEE MINING CO.

It is the intention of Manager L. F. Steenman of the Genessee Mining Company to continue the present 60-foot shaft to a depth of 300 feet before crosscutting, and if ore is not located, to sink to 375 or 400 feet, a new blacksmith shop, hoist-house, powder and store houses are erected on the property, and a new shaft house will be built shortly. A small gang of men is now employed on the property, and it is the intention to prosecute development work energetically.

The owners of the Genessee are optimistic of the outlook, the recent developments at the Chambers-Ferland having enhanced the prospects for the Genessee. The management is making connection with the Chambers-Ferland air line, which work was completed this week. The property will be undertaken at once, and the pumping out of the shaft will be commenced as soon as the air is available for the purpose.

The shaft on the property was sunk on a 4-inch vein of low-grade, and the present known vein system, together with the possibility of encountering the rich ore from the Chambers-Ferland, has encouraged the Genessee to institute a policy of thorough development.—Cobalt Nugget.

COBALT SHIPMENTS

Cobalt, Jan. 22.—The present week is the first for some time in which there were no shipments of bullion from the camp. The ore shipments, however, were considerably higher. Six mines shipped seven cars and all went to Canadian smelters, with the exception of one from McKinley-Darragh which went to Perth Amboy, N.J. In the list Casey Cobalt is included, shipping one car from New Liskeard. Nipissing led in tonnage, shipping two cars, both of them going to Welland, Ont. The shipment figures show a total of 535,892 pounds shipped for the week ending last night, against 465,943 pounds shipped the week previous.

Ore shipments for the week were as follows:

MINE.	POUNDS.
Nipissing	130,728
LaRose	87,100
McKinley-Darragh	69,077
Mining Corporation, Cobalt Lake	86,609
Peterson Lake, (Seneca ore)	83,492
Casey Cobalt	80,820
Total	537,829

Bullion shipments for the year, to date are:

	Bars.	Ounces.	Value.
Nipissing	214	251,675.15	142,196.75
Cr. Reserve	29	29,000.00	17,000.00

THE COPPER ORDER.

The following is a copy of the order issued by the British government setting a £100 (21 cent) limit on certain copper purchases:

I am directed to inform you that the minister of munitions considers it desirable to exercise a closer check upon the purchases of copper made by contractors to His Majesty's government for the purpose of carrying out munitions orders.

I am to request, therefore, that from the date of this circular you will observe the following rules in regard to such purchases:

(1) Orders up to and not exceeding 50 tons may be placed in the usual way without reference to the ministry.

(2) No order for "best selected" or "electrolytic" brands of copper should be placed at prices exceeding £100 per ton, without first consulting the director of materials, armament buildings.

MARKETS

NEW YORK MARKETS.

CONNELLSVILLE COKE

January 24th, 1916.

Furnace, spot	5.00
1st half 2.35—2.50. Year 1916	2.25—2.35
Foundry, prompt	3.50—4.00
Contract	3.00—3.50.

January 24th, 1916.

Straits Tin, b.o.f.	42.25
Copper—	
Prime Lake, nom.	25 00 to 25 50
Electrolytic, nom	25 00 to 25 50
Casting, nom.	24 00 to 24 25
Lead, Trust price	6 10
Lead, outside	6 10
Spelter, prompt western shipment	19 05 to 19 30
Antimony—	
English brands, nominal	
Chinese and Jap	42.50 to 43.00
American	42.50 to 43.00
Aluminum—	
No. 1 Virgin 98-99%	53.00 to 55.00
Pure 98-99% remelt.	51.00 to 53.00
No. 12 alloy remelt	43.00 to 45.00
Nickel	45.00 to 50.00
Cadmium nominal	$1.25 to $1.50
Quicksilver, nominal	$275.00
Platinum—	
Nominal	$88.00 to 100.00
Cobalt (metallic)	$1.25
Silver (official)	57 5-8

METAL PRODUCTS.

Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper	base 31.50
Copper wire	base 26.00 to 26.50
High sheet brass	base 34.00 to 36.00
Seamless brass tubing	38.00 to 40.00
Seamless copper tubing	38.00 to 40.00
Brazed tubing	38.00 to 40.00
Brass wire	34.00 to 36.00
Brass rods	34.00 to 36.00
Sheet zinc, f.o.b. smelter	23.00

TORONTO MARKETS.

January 26th, 1916

(Quotations from Canada Metal Co., Toronto)

Spelter	21 cents per lb.
Lead	7¾ cents per lb.
Tin	47 cents per lb.
Antimony	48 cents per lb.
Copper casting	26 cents per lb.
Electrolytic	26 cents per lb.
Ingot brass	yellow, 13c.; red, 15c. per lb.

January 26th, 1916.

(Quotations from Elias Rogers Co., Toronto)

Coal, anthracite	$8.00 per ton
Coal, bituminous	$5,25 per ton

STOCK QUOTATIONS

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto).

As of close, January 24th, 1916

New York Curb.

	Bid	Asked
Atlanta	.21	.22
Canada Copper	1.93¾	2.00
Am. Marconi	4.00	4.25
Belmont	4.25	4.37½
Goldfields Cons.	1.00	1.06¼
International Nickel	2.14	215.
Jim Butler	.93	.95
Jumbo Extension	1.31¼	1.37½
Riker Hegeman	5.50	5.75
Standard Silver-Lead (B.C.)	1 75	1.81¼
Stewart Mining	56¼	62½
Tonopah Extension	4 43¾	4 50
Tonopah Merger	55	60
Tonopah Mining	6 75	7 00
United Profit Shar	2 00	2 12½
West End. Cons.	79	81
Anglo-Amer. Oil	16 75	17 25
Submarine Corp.	38 25	39 00
Kennecott Copper	54 25	54 37½
Standard Oil of N.J.	5 07	5 10

Porcupine Stocks

Apex	7.5-8	7. ¾
Dome Consolidated	.19	.....
Dome Extension	.33	.33½
Dome Lake	.26	28.
Dome Mines	27.50	28.00
Foley O'Brien	60	75.
Gold Reef	01¾	. 2
Hollinger	29 00	29.75
Homestakes	42	.....
Jupiter	20	20¾
McIntyre	90½	91.
McIntyre Extension	29	31.
Moneta	12	12½
Porcupine Crown	83	87.
Porcupine Imperial	4 1-8	4¼
Porcupine Tisdale	1½	2½
Porcupine Vipond	73	74.
Preston East Dome	5¾	6.
Teck Hughes	16¼	18.
West Dome	15½	16¼.
West Dome Consolidated	23	23½.

Cobalt Stocks.

Bailey	4 7-8	5.
Beaver	40.	41½.
Buffalo	.....	90.
Chambers Ferland	28¼	28½.
Coniagas	4.55	4.75
Crown Reserve	52.	54¼
Foster	....	7½.
Gifford	7.	7¼.
Gould	7.	.....
Great Northern	4½.	4.7-8
Hargraves	3½.	5.
Hudson Bay	30.	35.
Kerr Lake	4.45	.....
LaRose	67.	70.
McKinley	40.	42.
Nipissing	7.25	7.50
Ophir	7½.	8½.
Peterson Lake	31¼.	32.
Right of Way	5.	6¼.
Seneca Superior	73.	78.
Shamrock Cons.	18.	18½.
Silver Leaf	2.5-8	2¾.
Temiskaming	68.	69.
Trethewey	16.	17½.
York Ontario	½	.1
Wettlaufer	8.	8½.

SILVER PRICES

January	New York cents	London Pence
10	56½	.....
11	56¾	26 15-16
12	57	27
13	56 7-8	27
14	57	27 1-16
15	56 7-8	27
17	56 3-8	26 3-4
18	56 5-8	26 7-8
19	56 5-8	26 7-8
20	56 3-4	26 15-16
21	56 7-8	27
22	57 1-4	27 3-16
24	57 5-8	27 5-16

CROW'S NEST.

Summarizing the year's results of the Crow's Nest Pass Coal Company, for The Financial Post, Elias Rogers, the president, says that the output of coal was about 877,000 tons and the output of coke about 266,000 tons. "Since Jan. 1, 1915," declares Mr. Rogers, "we have paid off all our indebtedness and have now a substantial balance in the bank. All bonds against the subsidiary companies have been paid and there are now no bonds oustanding against any of the companies, and no preferred stock. As far as we can judge, the prospects for the coming year are quite as good if not better than the past year."

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

BUYERS AND SELLERS OF METALS

The Canadian Miner's Buying Directory.

Air Hoists—
Canadian Ingersoll-Rand Co., Ltd.

Amalgamators—
Fraser & Chalmers of Canada, Limited.
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Canadian Miner's Buying Directory.—(Continued from page 16.)

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Roessler & Hasslacher.

ALPHABETICAL INDEX TO ADVERTISERS

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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 4

Lindgren—MINERAL DEPOSITS

By WALDEMAR LINDGREN, Professor of Economic Geology, in charge of the Department of Geology, Massachusetts Institute of Technology; Geologist, United States Geological Survey.

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Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, February 15, 1915. No. 4

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Editor

REGINALD E. HORE

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CONTENTS.

THE NICKEL ENQUIRY

The decision of the Ontario Government to appoint a Commission to study and report on the problem of refining nickel in Canada will be received with much interest. The Minister of Lands, Forests and Mines, Hon. G. Howard Ferguson, promises that great care will be taken in choosing the men to serve on the Commission. If this is done some useful information should be contained in the Commissioners' report. If men unfamiliar with the mining industry are chosen, they will probably spend most of their time and efforts in gathering such information as is already in the possession of the average mining man. A commission to investigate the nickel industry should be composed of men who know something about ore deposits and methods of treating ore.

While the war has been responsible for a new interest in the nickel question, the action of the Ontario Government is not to be regarded as a war measure. In spite of the sensational statements being made in some of the daily newspapers it may be confidently stated that nickel from Canadian ores is not reaching Germany. The Canadian public should not be misled by the newspaper agitation into believing that the Government's assurances are not to be relied upon. From the articles appearing in the newspapers it seems that many Canadians actually believe that the export of nickel matte from Canada during the war is an advantage to Germany.

It is the duty of Canada to prevent nickel from reaching the enemy. The Dominion Government has shown that it can be depended upon to handle the situation. As long as the war lasts careful supervision of shipments will be necessary; but for the present we are advised that all is well.

MINE, QUARRY AND DERRICK

The many friends of Mr. J. C. Murray will be pleased to learn that he is now editing Mine, Quarry and Derrick, a fortnightly magazine published in Calgary. The first issue has just been received and bears the date Feb. 3rd, 1915. It contains articles by J. B. Tyrrell, L. S. Kempher, W. G. Worcester, R. W. Coulthard and E. H. Cunningham Craig.

While chiefly devoted to the oil industry, the magazine presents information on all phases of the mineral industry. Mr. Murray says:

"No one branch of the mineral industry will receive attention to the exclusion of others. Naturally, exploration for oil will for a time at least be a leading topic. But it will be our endeavor to give due promi-

nence to coal, metals, building materials and all the various minor mineral deposits, heretofore neglected, in which the Canadian West abounds. We shall also publish articles treating of their exploitation and uses."

The mineral resources of the Prairie Provinces are large; but information concerning them is not readily available. Mine, Quarry and Derrick should be well received by those interested in the development of the mineral resources of the Dominion.

Mr. Murray was for six years Editor of the Canadian Mining Journal, and is well known throughout Canada. We wish him every success in his new work.

THE MINERS' "V.C."

"Coal Age," a New York weekly devoted to the literature of coal mining, in a recent issue, asks: "Is it not about time that someone was suggesting a suitable method of rewarding the individual bravery displayed in mine rescue work?" This editorial evidently has in mind the saving of life after mine disasters, or explosions in coal mines, and makes specific reference to the "Rescue Men in the employ of the Bureau of Mines" (U. S.). The writer does not express himself with absolute clarity, but he hints at a national organization in the United States for mine rescue-work, points out that jealousies spring up when several crews offer their services simultaneously, and makes the following curious observation:

"It is a fact that just now any coal operator might feel justified in preventing even a U. S. Bureau of Mines instructor from entering his mine, following an explosion, if he felt so inclined."

There are circumstances which would fully justify a coal operator, or a colliery manager, from preventing any would-be rescuer from entering a mine after an explosion. It is the tendency of "rescue crews" to rush into an exploded mine without proper leadership, plans or equipment, that is bringing disrepute and justifiable criticisms upon so-called "rescue-work." The number of lives saved after coal mine explosions is disappointingly few, and only too often the original death roll has been increased by ill-advised or ill-conceived attempts at rescue. It is just here that we think the writer in "Coal Age" is venturing on dangerous ground, particularly when he hints at a possible conflict of opinion between a Bureau of Mines instructor and a responsible mine official, for nothing can, or should, relieve the mine manager of his responsibility and authority. We agree that the advent of oxygen breathing apparatus, a specialized device requiring specially trained men to satisfactorily use it, has marked out a certain group of men as peculiarly fitted to undertake "rescue-work" after mine explosions, and that some scheme of national organization whereby these men would be recognized somewhat in the same way that paid firemen are recognized, is desirable, and preferable to the present haphazard arrangements; but there is a danger of attaching too much importance to this particular phase of bravery among miners. Catastrophic happenings like a great coal mine explosion always bring out some hitherto unknown hero, but it is in the daily routine of underground work that the miners' bravery is best and most often exemplified.

We offer for the consideration of our mining friends in the United States a report from the London Times of the 14th January, describing an Investiture by the King, where amongst a list of those who received orders of knighthood, Victoria Crosses, Distinguished Service medals, and decorations for conspicuous gallantry, we notice three awards of the "Edward Medal," the "Miners' V. C.," as it is sometimes called, the decoration instituted by Edward VII. for bravery in mines. The official particulars are given in another column of this issue. Each of the three medals was granted for a deed of bravery arising out of the ordinary duties of the mine, that involved sheer dogged bravery, but nothing spectacular. It is interesting to note that one of the medals went to South Africa, and was given for the rescue of two native "boys." One of the things which endeared King Edward to his loyal people was his recognition of the heroes of industry and of civilian life, a tradition that is being worthily maintained by King George, and no decoration was ever conceived in a happier spirit or had more justification than the "Miners' V. C." So far as we are aware no grant of this medal has yet been made to a Canadian miner; but there was one case in the West where, if the hero had survived his act of self-sacrifice, the decoration was richly earned. It is a significant commentary on our national character that in the midst of our world-wide combat against a stubborn and unscrupulous enemy, the King can find an opportunity to recognize the unassuming bravery of those who labor among "the stones of thick darkness and the shadow of death."—F. W. G.

CORRESPONDENCE

CANADIAN MINING INSTITUTE BY-LAWS

To the Editor of the Canadian Mining Journal:

Sir,—In response to your invitation to your readers to express opinions on this subject, I would briefly review the features of the proposed amendments that seem to call for comment.

A system of representation on Council by sections or provinces is proposed, in which representation shall be proportional to the number of members resident in each of the various provinces at the time of nomination. The candidates for office are to be nominated by members living in the province they may represent, and of which they must themselves be residents. Owing to the wide distances to be traveled, members for more than two of the proposed provinces can rarely, if ever, attend meetings of Council wherever they may be held. Consequently, the remaining provinces would as rarely be represented. On the other hand, many members who reside in one or other of the cities in which meetings of Council are usually held, have their

interests in the more remote provinces, and in fact are members owing to those interests. Such men are now commonly selected for offices for this reason; but by this seemingly ill-judged clause of residence, they could no longer represent the provinces in which their interests lie. To give even a semblance of equity to provinces far distant from the place of meeting, at least one-half of their representatives should be selected from the membership at large, so as to secure those who could attend executive meetings.

Another clause that seems equally unjust is that although a province may nominate its own candidates, they shall be elected by the votes of the entire Institute. Judging from such lists of members as are at hand the twenty elective members of Council would, under the proposed scheme, be distributed at the present time somewhat as follows:

British Columbia and Yukon	4
Alberta, Saskatchewan and Manitoba....	2
Ontario............................	10
Quebec............................	2
Maritime Provinces	2

Now if two candidates are nominated for the same office in Ontario, the selection between them would be made by a vote to which this province would contribute only one-half; if in British Columbia, one-fifth, and in the other provinces, one-tenth, with the corresponding chances that the candidate so elected would be the choice of the province he represents. When we reflect that under the condition of residence that is imposed on candidates, three of the proposed provinces could only nominate representatives to stay at home anyway, and that they would then have only from one-fifth to one-tenth of the final voice in selecting even these, this amendment can hardly be called a brilliant stroke for representative government. It would seem to be rather a kind of representation that does not represent much.

Underlying these particular features, however, is the general and more important question whether the elections of the Institute would be better conducted in provincial divisions, or under the broader national system that has been hitherto followed. It is of the first importance to hold the Institute closely together as a truly national organization. Sectional divisions, even in such minor matters as elections of officers do not tend to unity. The Institute represents an industry rather than a profession, and consequently its activities are distributed more according to the needs of the industry and the opportunities of usefulness, than with regard to the ever-changing place of residence of its members. The splendid growth and activity of the Institute during the seventeen years of its existence has been attained under a national system.

However, if any change for the better can be made, one that will strengthen the entirety of the Institute or increase its usefulness, let us by all means be ready to adopt it. But let us be sure that it is a change for the better, investigate it thoroughly and give it deliberate consideration before trying any experiments with it, especially in this, which is bound to be a year of trial to all such organizations.

Yours, etc.,

JOHN A. DRESSER.

Sault Ste. Marie, Ont., Feb. 6th, 1915.

B. C. MINERAL PRODUCTION IN 1914

To the Editor of the Canadian Mining Journal:

Sir,—You were good enough to publish in the Journal of January 1 a letter in which I called attention to what appeared to me to be an inaccuracy in the printed address of the president of the Bank of Montreal, in which it was stated that "it is estimated that the total mineral production of British Columbia for 1914 will be 75 per cent. of last year." As compared with that statement, I submitted that my own estimate was that it had been approximately 85 per cent. Since then there has been printed in western newspapers what I take to be an authorized account of the address of the general manager of the Royal Bank of Canada, at the annual meeting of the bank held in Montreal on January 14, in which it is stated that "the mineral output of British Columbia for 1914 is estimated to be 80 per cent. of the output of the previous year, or about \$25,000.000 in value, against \$30,000,000 in 1913. This decrease is caused by the inactivity of the smelters on account of market conditions and by labor troubles among the coal miners."

Now, while it is pleasing to find the general manager of the Royal Bank conceding this Province an output in value five per cent. higher than did the president of the Bank of Montreal (though he might have been fairer by giving it credit for the 83 per cent., the totals he quoted showed it be entitled to), I shall be glad to be permitted to call attention to the fact that an official estimate is now available and that this shows a total value of \$26,189,020, or 86.4 per cent. of that for 1913.

My chief object in now writing, though, is to take exception to the assertion of the general manager of the Royal Bank of Canada that the decrease in production was caused partly "by labor troubles among the coal miners." On January 15 there appeared in the Journal, pp. 58-60, a review of "Coal Mining in British Columbia in 1914," which gave some detail relative to the output of the different parts of the Province that produce coal, so I shall not here do more than show totals for districts as under:

District.	Gross Production of Coal 1913. Long tons.	1914. Long tons.	Increase or Decrease. Long tons.
East Kootenay	1,331,725	972,507	D. 359,218
Nicola & Similkameen	265,542	136,140	D. 129,402
Total, Interior ...	1,597,267	1,108,647	D. 488,620
Vancouver Island ...	973,493	1,064,913	I. 91,420
Total, Province ...	2.570.760	2,173,560	D. 397,200

There were no labor troubles at Interior coal mines in 1914, yet there was decreased production. On the other hand, there was increased production on Vancouver Island, where the United Mine Workers of America, although there was available all the independent labor required, and more, too, for working the coal mines, did not "call off" their strike until after the year had been well advanced. So that the long-distance opinion expressed by the banker was not justified by the facts of the case.

The mining industry has troubles enough, without men holding prominent positions in the financial world of Canada adding to them by making inaccurate statements as to its difficulties. Yours, etc.,

E. JACOBS.

Victoria, B.C., Feb. 1, 1915.

CALGARY OIL

To the Editor of the Canadian Mining Journal:

Sir,—I beg to call your attention to an article appearing on page 87, February 1st. issue of the Canadian Mining Journal, under the heading Calgary Oil, in which there are statements quoted that I am supposed to have made regarding the Calgary oil fields, in my address at the annual meeting of the Conservation Commission recently held in Ottawa.

The statements that I did make on this subject, and which will appear in the report of the Commission of Conservation, are:

"The great need of discovering new sources of supply of petroleum to meet this ever-increasing demand led to the employment by the Mines Branch of Mr. Clapp, one of the ablest petroleum experts of the United States, to make an investigation of the oil and gas resources of the Dominion, with special reference to the geological indications of the existence of oil in the Province of Alberta. While the indications of the existence of petroleum in Alberta are promising, no large producing oil wells have as yet been developed."

Yours, etc.,

EUGENE HAANEL,

Ottawa, Feb. 8, 1915. Director of Mines.

ENQUIRY INTO THE NICKEL INDUSTRY ORDERED

The Minister of Lands, Forests and Mines, Mr. G. Howard Ferguson, has given out the following statement:

Conditions that have arisen out of the present war have made the nickel industry of Ontario the subject of a great deal of discussion.

The nickel lands of the Canadian Copper Company, the Mond Nickel Company, the British American Nickel Corporation, and other corporations and individuals, were sold years ago under a former government in fee simple, without any restrictions or limitations as to the working of the mines or the disposition of the products thereof.

The question, however, of refining nickel in Ontario is by no means a new one. It has received the attention of successive governments, and it was the well-known policy of the Whitney Government, as it is of the present government, to do everything possible to secure the refining of nickel in Ontario, when satisfied that it was commercially practicable so to do.

To this end legislation was passed in 1907, authorizing the payment of a bonus of 6c. per pound on nickel refined in this province, and that legislation is still in force. Moreover, the Department of Mines has constantly had this matter in view with the same object. The nickel industry in Ontario is a very large and important one, expending several millions of dollars in labor and supplies in this province, and up to the present time the government has not been convinced that any action preventing the export of nickel would not have the effect of transferring the nickel business, or a substantial part thereof, from Ontario to New Caledonia, Norway or elsewhere.

Up to the present there does not appear to have been any known process of refining the Sudbury copper-nickel matte that would have permitted of the operation being a commercial and economical success in Ontario.

Metallurgical science, however, has made rapid advances in recent years, and it may be that the conditions with respect to the nickel industry have materially changed. In order to ascertain all the facts and acquire full knowledge of the situation, it has been decided to appoint a commission to investigate the whole question. If the report of the commission makes clear the practicability of refining nickel in Ontario, the necessary steps will be taken to see that this is brought about.

This commission will also consider whether the nickel and other mining industries of the province are paying their full share of provincial taxation, and the proper basis upon which such taxation should be levied. The commission will have plenary power to exhaust every possible source of information and make a careful study of every phase of the question and make a complete report thereon to the government.

It is scarcely necessary to add that a subject of such magnitude and complexity can only be properly dealt with by men of exceptional ability, and those to be selected will be men of special qualifications, who will command the fullest confidence of the public.

"THE LION LED THE LINE"

(Vide Admiral Beatty's Despatch, 24th Jan., 1915.)

The Lion and the Tiger were sailing on the sea,
And with them sailed a Princess allied to royaltee,
Also a buxom damsel who wore the Southern Cross,
A cruising all together—and Beatty was the Boss.

Said the Lion to the Princess, as he "led the line,"
"Could we only sight those wharf-rats, wouldn't it be fine?"
Quoth Miss New Zealand, briskly, "You've voiced my very wish,
"As we did at Heligoland, we'll feed them to the fish."

"I've just got back," the Princess said, " 'cross the Herring Pond,
But not a single German rat my keen-eyed tars have conned.
From Halifax to Boston, Mass., Sambro to the Naze,
Not a 'baby-killer' passed within my anxious gaze."

Just then, the Lion roared, for you see he "led the line,"
And he had spied a wharf-rat, skedaddling for the Tyne.
The ladies both tucked up their skirts, and started for to run,
They said: "It is a LONG time since we have had such fun."

The Lion plunked the Blucher first, as he "led the line,"
The Tiger passed—plugged her too—it—certainly was fine!
The saucy Arethusa gave her the final bump,
And throwing out the life-belts, yelled: "Jump, ye beggars, Jump!"

The Derflinger she ran away—Moltke he ran too.
Then—the Lion hurt his toe—the atmosphere turned blue!
The language of the sailors came from their inmost souls,
As the fleeing foes went limping, squeaking, to their holes.

Next time the Scarboro murderers slink out to raid our coast,
They'll hear again from Beatty, and sailormen may boast;
"Our babes shall sleep in safety, in Scarboro' and on Tyne,
So long as Tiger watches, and Lion leads the Line."

—F. W. Gray.

PERSISTENCE OF ORE IN DEPTH

By F. Hille.

It is not a rare experience to find otherwise clever professional men become, owing to over-confidence in their ability, often blindly one-sided, and sometimes even reckless in their conclusions and assertions regarding certain subjects.

This was again impressed upon me by reading in the Canadian Mining Journal an excerpt of a paper by Mr. T. A. Rickard, entitled "Persistence of Ore in Depth," that was presented to the Institute of Mining and Metallurgy in London during its December meeting. Of course, the readers of Mr. Rickard's publications should be, by this time, well accustomed to his often brusque nonchalance, in treating certain topics, and this is repeated again in the above mentioned paper, the subject of which has become, I might also say, his hobby. His illustrations used in trying to make a case, although very entertaining, should have hardly been necessary, because the subject is of sufficient interest and importance; however, "de gustibus non est disputandum," it is the underlying abrupt conclusiveness to which I object principally.

Everyone of any experience in economic geology knows how extremely hazardous it is to draw a parallel between two ore deposits in two different or even in one and the same locality, on account of the basic differences underlying, in most cases, their origin. How still more risky it is to attempt to treat in this matter the whole multitude of ore deposits, and to patch up, out of certain similitudes, a hypothesis that is to fit the whole question. The practical geologist or mining engineer finds in his mine or field operations very soon that the experience gained in one region or camp is not, or if so but rarely, applicable in another. Therefore the quicker he discards his former experience or preconceived ideas the better for everyone concerned.

Depth is the gist of the paper in question, but what does the author mean by "depth"? "Persistency of Ore in Depth," does not exist, he says. Why not? He does not explain. Now I thought every theory propounded had to be based on a law that is to prove its correctness, and that if this cannot be done, then the theory is wrong. To prove his contention by citing a few mines in which payable ore has not been found in depth, is no proof; because an equal number of other mines could be enumerated upon which the above assertion would not hold good. Even some of those very mines cited would disprove his contentions.

Depth is undoubtedly necessary in case of a low grade deposit, that is, if the width does not make up for a deficiency in the former, because the mass or quantity of the ore has, in this case, to be the profit bringer. With a rich deposit depth would not be so essential, at least not in the same measure as in the former, although, of course, desirable. Let me cite here the Cobalt silver mines which have paid largely even at shallow depth; the same can be said with some of the Port Arthur silver mines and of the Comstock. The money expended on these mines was surely not "the transferring the earnings of the many to the pockets of the few."

What depth then, in the opinion of Mr. Rickard, would be necessary to constitute a paying mine? Without knowing this, it is difficult to offer an effectual refutation of his claim. I do not attribute to him, as someone mentioned in discussing his paper, that he meant the depth of every ore deposit to cease only at its antipodian region; neither also that they need to go farther into the bowels of our globe than our present or future mining methods would permit. But he will not deny that 4,000 to 5,000 ft., at which a number of mines are working with a profit to-day, is not exactly a shallow depth. These same mines, who knows, may go even as many feet deeper yet without our finding the ground too poor for profitable working. And why should they not? How many mines would be in operation of equal depth or more to-day, had no erosion, glacial action or later plutonic activities deprived us of thousands of feet of those deposits of which we are working the truncated parts now.

However, depth is not the only factor in which we have to decide the value of an ore deposit. There are others equally as important, genetic occurrence, width, horizontal extent, mineralization, occupation and form in the rocks by which they are encased, communications, market, labor, etc., etc.

Now then, what is depth? Depth, as I understand it, is: (a) That place from where the contents of our metal veins originated, and (b) That place in which the contents of our metal veins found their lowest rest or seat.

In this class I include only such deposits as are produced by volcanic emanations.

(a) The place of origin is deep seated; plutonic rock intrusions, the source of gaseous emanations, may have come to rest in their upward pressure miles below our earth's surface, and in course of time gradually cooled to such an extent that a continued deposition of mineral matter reached down to almost its starting point.

(b) Apophyses of a volcanic rock injected into the upper horizon of our earth's crust created an exit for gas emanations along their course; but owing to the long retained heat of the rock the gases mingled with their own and meteoric waters, and then deposited their mineral contents close to the earth's surface, that is, in certain horizons of cooled rock strata.

It will be seen that between these two extremes, any depth would be produced according as the conditions were favorable one way or another.

Now to find out these depths involves a patient study of the stratigraphical geology, and an equally patient observation of the mining operations in progress in each mineral region.

During the course of our labors we will then have observed, also, what role the rock or rocks of the immediate vicinity have played as affecting the distribution of the minerals and metals throughout them, whether they are formed in connecting solid deposits—veins—or scattered throughout a shattered rock, forming mineralized zones that may allow or not allow a profitable working. Further, we have to consider whether the mineral contents of veins were uniformly deposited or whether intermittently.

All these conditions give to each mineral district special characteristics which have to be considered in our calculations. If we enter upon our duty with an air of infallibility, or a notebook full of preconceived ideas that are dispensed upon every occasion, we usually damage ourselves as well as our clients, and, in no less a degree, the country or locality in which these deposits occur. Such superficialities are then, not merely excusable professional errors, but inexcusable professional sins.

And I am compelled to accuse Mr. Rickard of the latter when he claims that the ore deposits of the Rainy River district belong to that class, with no "persistence of ore in depth," and that consequently "they have had their day." Mr. Rickard will see the day when the deposits of that district will not only show depth, but will also show themselves to be the most important on this northern continent; some of them will rank with the Treadwell and Homestake, and some with the best of the Nevada mines. That these mines were closed in years gone by, was not due to the diminishing of values in the ore, or giving out of the ores. On the contrary, some of them have steadily widened, in some instances with an increase of value. I may mention only a few.

One of the most important widened from 8 ft. at the surface, and with an $8 to $10 ore, to 25 ft., and over $20 in 600 ft. depth, and is still widening.

Another has some ore shoots in the 300 ft. level that assay over $20, and have a width of about 20 ft. There was no sign of these at the surface, where only a small vein, although persistent in strike, was encountered.

I may mention also one of the low grade deposits, being of immense size and having a horizontal extent of over two and three-quarter miles, and a width from 150 ft. at both ends to over 400 ft. at the centre, assaying as far as ascertained in the neighborhood of from $3.50 to $4.00 on the average.

I could cite a number more of these low grade ore bodies that exist here, which are mineralized zones of a sheared granite along faults, and to which we can attribute a depth equal to that of the granite.

The reason that most of these deposits are not under full exploitation at the present time is partly owing to such careless and unfavorable criticisms by persons who know absolutely nothing about them, but use, like Mr. Rickard, "hearsays" to prove a hypothesis which is absolutely indefensible.

The illustrations and similes used by Mr. Rickard for proving his point may be entertaining, but must have been absolutely unconvincing to the audience which he was addressing; proof of which is the discussion on his paper. It is difficult to understand why a man of Mr. Rickard's calibre succumbed in a weak moment to the temptation of bringing this subject before the Institute. Did he wish to show his sympathy and to prove that he has an ever vigilant eye for the dear, poor, stock-buying public? Vain attempt, the stock buyer is usually shrewd enough and keen-eyed enough not to be humbugged; he sees, as well as others, that there are many dividend paying mines in the world, and that, consequently, mining must be as legitimate a business as any other one. It is difficult enough to convince mining companies that in order to assure success to a mining enterprise, money is necessary. Why then block the way to success?

Preaching ethics to a whole industry or profession is very laudable, that is, if I have a cause or base for my sermon; but "fighting a cyclone with windmill wings" is a peculiar undertaking.

Mr. Rickard should know that flamboyant prospectuses or highly colored reports, have the sign of failure on their forehead, and are therefore not to be taken seriously. Mines are rarely started nowadays by small capitalists; usually large mining companies or exploration companies are interesting themselves in the developing and exploitation of ore deposits, and these companies are well supplied with good, responsible engineers. Why should it be necessary to warn them to beware of "make believes" or "reckless optimism," and what else not?

WETTLAUFER.

Wettlaufer Lorrain Silver Mines, Limited, report for 1914 shows a credit balance of $29,680, with sundry investments set down in the balance sheet at $109,912. Proceeds from sale of ore amounted to $11,913. Other receipts brought the year's income to $17,530. Expenses were $12,367. Profits were thus $5,163, despite the fact that the mine was not open.

The president, Henry Lockhart, Jr., said: Your properties have been opened since October 31, 1913, and the only expense the company is now under at the property is that of keeping a watchman, and pumping. It was decided at the last annual meeting to devote such of the company's resources as your directors might decide to the acquisition of other properties, and while several have been considered during the past year, we have not found one sufficiently attractive to warrant investment. Your board is continuing its endeavors in this direction with the hope of finding, in due course, a suitable property.

General Manager Livermore, in his report states: During the year no mining operations were carried on. The mine was allowed to fill up with water to the fourth level, but was kept free above that level, in order to keep the mine open for possible further work. So as to avoid the expense of running the compressor, a Gould plunger pump, electrically driven, of capacity ample to handle all water made by the mine, was installed at the fourth level.

The mine and property has been left in charge of a caretaker, who lives at the shaft, and who keeps the mine pumped out. All plant and equipment have been kept intact and in good order on the property. Occasional visits are made by your manager.

The question of the advisability of doing further work in the mine was thoroughly considered, but on account of the barren results obtained from development up to the time of shutting down, lack of good surface indications on that part of the property not opened underground, and because of the expense of putting the caved-in shaft in condition, no work was undertaken.

Meanwhile, a considerable amount of examination of new prospects and mines has been done in the Lorrain, South Lorrain, Kirkland Lake, Elk Lake and Cobalt districts and elsewhere. Some of these have been of no worth, while others have offered some prospective value, but no suitable terms could be obtained.

The situation regarding possible new finds in the Wettlaufer mine has not changed from that detailed in the last annual report, that is, the prospects are poor, although it is barely possible that some of the development being done at the time of shutting down was not carried far enough to disprove absolutely the existence of other veins.

Arrangements have been made whereby the ordinary rate of two cents per ounce, applicable to all letters sent from Canada to the United Kingdom, will apply to letters addressed to British and Canadian troops on the continent. The rate on ordinary letters from Canada for the continent is five cents for the first ounce, and three cents for each subsequent ounce, so that this extension of the two cent an ounce rate to letters addressed to our soldiers on the continent, is a decided reduction in favor of correspondence going to the soldiers.

METALLURGICAL PRACTICE IN THE PORCUPINE DISTRICT*

By Noel Cunningham.

Many excellent descriptions of the mills of the Porcupine district have been written, but no discussion exclusively devoted to the metallurgical technology has been given. These notes are intended to cover this feature briefly. They are based upon 2½ years' mill operation in the district—i.e., practically since the beginning of metallurgical operations.

Character of the Porcupine ore.—There is no oxidized ore in the district, the surface having been deeply planed by glacial action in recent geologic time. The precious metal content is about in the proportion of 85 of gold to 15 of silver by weight; hence, the silver is practically negligible. There are two classes of Porcupine ore, having very different characteristics; these will be referred to throughout this paper as Class A and Class B.

Class A ore is a pure quartz with inclusions of schist. Generally it is heavily fractured and breaks down readily to sharp, hard grains, about minus 10 plus 20 mesh, requiring further comminution to release the gold. It carries very little pyrite; the gold is entirely free and apt to be coarse, but often spongy, going into solution readily on that account. This gold is 60 per cent. to 85 per cent. free milling, depending on the grade of ore.

Class B ore is an iron silicate schist, strongly laminated, carrying 4 to 5 per cent. pyrite; its specific gravity is 2.8 to 3.0, depending upon the amount of mineralization. In breaking the ore in the mine, generally over 25 per cent. of material through a ½ in. ring is made; the ore readily breaks down in milling and makes a comparatively large amount of non-crystalline slime; owing to its high specific gravity, however, it is quick settling. In my opinion, the gold in this ore is free, but so finely divided that it will neither pan nor amalgamate; it appears to be disseminated through the rock and not chiefly associated with the pyrite.

Veins of Class A ore occur with or without side walls of Class B, and veins of Class B occur unassociated with Class A; more often the veins are closely banded, Class A and Class B alternating, generally with Class B in excess. Both classes of ore are more or less blocky at times, and with reference to Class B this is indicative of low gold content.

From a treatment standpoint neither class of ore introduces any important difficulty, although there seems to be a tendency toward reprecipitation, due probably to some element in Class B material. Practically no cyanicides are present in the ore, chemical consumption being about 0.2 lb. of cyanide per ton of ore; 1 lb. cyanide solution is sufficient for extraction, and protective alkalinity may be carried very low. With a well designed battery and tube mill installation, a stamp duty of 15 tons or better can be readily maintained.

Outline of Treatment and Development at the Principal Mills.

Although excellent descriptions of the mills and treatment methods of the Porcupine district have appeared in the technical press, it will be of benefit to outline the treatment in the five principal mills of the district in chronological order, and to comment briefly on the metallurgical trend indicated.

First Hollinger Mill.—Destroyed by fire before ready to operate. Treatment intended: Fine crushing, plate amalgamation and concentration of tailing.

First McIntyre Mill.—Designed for treating Class A ore. Crushing by 10 light stamps, fine grinding, plate amalgamation and concentration of tailing from amalgamation. As the mine developed, chiefly Class B ore was produced, from which an extraction could not be made by amalgamation. This mill was shut down after about a year's run.

Vipond.—Mill of 100 tons capacity, treating a mixture of Class A and Class B ore. Treatment: Fine grinding and plate amalgamation. Simple amalgamation did not make a satisfactory recovery of the gold and the mill was shut down after a few months' run. Recently the mill resumed operation, amalgamation having been abandoned and a cyanide plant added. Treatment: Fine grinding in cyanide solution, agitation and complete counter-current decantation.

Dome.—A 40 stamp mill, recently increased to 80 stamps, treating a mixture of Class A with a less amount of Class B ore. Treatment, at start: Stamping in water, primary amalgamation, fine grinding, secondary amalgamation, dewatering, agitation in cyanide solution, Merrill filters, to waste. Later: Stamping, tube milling, and plate amalgamation in water, cone classification to three products; (a) slime, dewatered and agitated in cyanide solution, Merrill filters to waste; (b) sand, leached; (c) concentrate, reground in tube mill in closed circuit with classifier and amalgamation plate, classifier overflow to slime treatment.

Hollinger.—A 40 stamp mill, recently increased to 60 stamps, treating a mixture of Class A and Class B ore, the latter predominating. Treatment, at start: Stamping in solution, fine grinding, concentration, concentrates amalgamated in solution and returned to table tails, table tails to agitators, to Moore filter, to waste. Later: Stamping in solution, fine grinding and concentration, concentrates agitated in strong solution, washed and impounded; table tails to two steps of continuous decantation, to filters, to waste. Now building: Plant for agitation and complete counter-current decantation for one-third of the tailing from table concentration.

Porcupine Crown.—Plant with 10 light stamps, later increased to 20, treating Class A ore entirely. Treatment, at start: Stamping and fine grinding in water, followed by plate amalgamation. Later: Stamping and fine grinding in solution, with plate amalgamation in closed circuit with tube mill and classifier, followed by agitation and complete counter-current decantation.

Second McIntyre Mill.—Plant of 150 tons capacity recently increased to 300 tons, treating a mixture of Class A, with large preponderance of Class B ore. Treatment, at start: Fine grinding in solution, agitation, Burt filter to waste. Later: The capacity was increased from 150 to 300 tons, the treatment being unchanged except that continuous decantation replaced filtration in the new unit.

Acme Mill.—Now building with 40 stamps, to treat a mixture of Class A and Class B ore, the latter preponderating. Treatment: Stamping and fine grinding in solution, agitation, concentration, concentrates to be reground in solution, agitated, washed and impounded, table tails to be treated by decantation.

*A paper to be presented at the New York Meeting of the American Institute of Mining Engineers, February, 1915 and at the Toronto Meeting of the Canadian Mining Institute, March, 1915.

Analysis of the Milling Practice.

A tendency toward extensive alteration in treatment methods will be at once apparent from a consideration of the above outline of milling practice and development. This is chiefly due to the fact that large bodies of Class B ore are now being developed and treated, whereas the design of most of the mills was determined almost entirely from tests upon Class A ore. The entire failure of straight amalgamation is obvious. Amalgamation in conjunction with cyanidation is practised only at the Dome, where large bodies of Class A ore are yet to be treated, and at the Porcupine Crown, where to date only Class A ore has been found. At the latter mill, however, only a small plate area is used in the classifier tube mill closed circuit, as the ore contains a large amount of coarse free gold which is readily caught at this point.

The equipment of the Porcupine mills offers good opportunities for comparison of various machines for doing the same work.

Stamps versus Rolls and Hardinge Ball Mills.—At the Vipond and the McIntyre mills, rolls and ball mills are doing the work done by stamps at the other mills. The ore is chiefly soft schist and the ball mills have been entirely satisfactory; power per ton of ore ground appears to be slightly higher than with stamps for the production of identical results. Steel consumption is about the same, the stamps perhaps having a shade the better of the argument in this respect; cost of operation and repairs is in favor of the ball mill, while first cost and uniformity of operation (what might be termed lack of operating "grief") are decidedly in favor of the ball mill. While my own experience in the district has been entirely with stamps, and their performance was satisfactory, I am of the opinion that the ball mill is preferable for breaking down the Porcupine ore ahead of the tube mills.

It may be of interest to note in passing that at the McIntyre a first-class Chilean mill was discarded in favor of the ball mill after the two had run side by side for a year. At the Vipond, Hardinge pebble mills are used for fine grinding, while cylindrical mills are in use in all the other plants. I do not know how the conical mills compare with the cylindrical mills in first cost, power required, performance, etc., but on theoretical lines I favor the cylindrical mill, where coarse gold is to be dissolved in solution, as more effectively trapping the gold particles and wearing them down to microscopic fineness, owing to the vertical end of the mill.

Stamping in Water and Amalgamating versus Stamping in Solution with No Amalgamation.—Probably the best opportunity for studying this point is afforded by a comparison of the Dome and Hollinger practice. The advantages claimed for stamping in water and amalgamating are a better recovery of the coarse free gold and the saving in treatment cost, due to a smaller amount of solution to precipitate and a smaller amount of precipitate to handle. At first sight it would also appear that a saving in dissolved losses from the filters would be made, owing to the smaller amount of gold in solution going to the filters.

While at the Hollinger there is a smaller percentage of amalgamable gold in the mill heads than at the Dome, on the other hand, the coarse free gold per ton of ore in the mill heads is about the same due to the fact that the head assay is nearly triple that of the Dome. Hence, if amalgamation is necessary in order to assure the dissolution of coarse gold in cyanide solution, difficulty from this source should be experienced at the Hollinger, where crushing is in solution with no amalgamation.

This is not the case, however; all the coarse gold goes into solution in the classifier tube mill closed circuit. This is proved by two facts in connection with the Hollinger operations. Table concentration after fine grinding is practised at the Hollinger, and any coarse free gold passing the tube mill classifier closed circuit would be caught on the tables. No coarse gold is present in the table concentrates, however, no color of free gold ever showing on the tables; also practically no amalgam was produced (under 1 per cent. of the total values recovered) during six months, pan-amalgamation of concentrates from the tables.

Facts also indicate that crushing in solution without amalgamation has the best of the argument in regard to amount of solution precipitated and dissolved gold mechanically lost. With the head assay at the Hollinger about three times as high, the precipitation ratio is only about twice that at the Dome, and the mechanical loss of dissolved gold and cyanide only about one-half. Nor is any saving in dissolved losses or treatment cost proved in favor of crushing in water followed by amalgamating. On the other hand, there are added to the treatment cost (1) cost of amalgamation, (2) cost of increased cyanide consumption due to "waste" solution precipitated and thrown away, and (3), in winter the cost of heating to mill temperature the quantity of water—equaling several times the weight of ore treated and introduced at nearly a freezing temperature—to replace the water and waste solution discharged with the tailing, which would not be necessary if crushing were done in solution. The loss of gold left in "waste" solution after precipitation must also be added to the cost.

In comparing Dome and Hollinger metallurgical practice, it is only fair to state that since the Dome ore is harder and more compact, the gold may be less spongy and therefore less amenable to cyanidation. The only deduction which can be drawn from the facts, as far as I know them, is, that apparently in treating average and low grade ore of the district amalgation can be eliminated; that if amalgamation is eliminated and solution introduced at the stamps, a considerable saving in operating cost, cyanide and dissolved gold losses is possible.

Unquestionably more extensive study has been given to the treatment of the Dome ore than to any other in the district. Hence one hesitates to make what may appear to be a criticism of an operating system probably justified by a careful balancing of co-ordinate factors by an eminent firm of metallurgists. However, no metallurgical discussion would be complete without touching upon this point, which is the salient difference between the two metallurgical systems of the district.

Concentration versus Non-concentration.—The Hollinger is the only mill making a table concentration. About 16 per cent. of the gold in the ore is recovered in the concentrate, and the advantages claimed would indicate that the possibilities justify careful consideration. The pulp, with the concentrate removed, needs much less careful treatment than the entire pulp, concentrate included, would require, hence a small tonnage of concentrate may be given whatever treatment it demands to get the best result, while the large tonnage of pulp free from concentrate may receive the much smaller amount of attention it requires.

Table concentration at the Hollinger costs about 5c. per ton of ore treated and recovers about 80 lb. of concentrate per ton of ore, assaying about 2½c. per lb., worth, therefore, about $2. In the careful treatment given the concentrate the value per lb. of concentrate is brought down to about 0.3c.; in other words, a sav-

ing of \$1.76 is made from the 80 lb. of concentrate from each ton of ore, which is a large enough amount to warrant the expenditure of 5c. to safeguard. The performance of the thickeners and filters is improved if a feed can be maintained composed of particles of one specific gravity, so that from the standpoint of better mill performance, due to keeping the concentrates out of the thickeners and filter, I am of the opinion that the expenditure of 5c. per ton of ore is justified where the concentrates taken out amount to say 4 per cent. or more of the total tonnage. Another advantage is that even after a very careful treatment the concentrate tailing assays from \$5 to \$7 per ton of concentrate, equal to 12c. to 20c. per ton of ore. Also the saving in treatment cost, due to the less agitation required for the pulp freed from concentrate, should be credited to concentration. Hence, I should say that if table concentration cost 20c. per ton, instead of 5c., it would still be justified when a considerable amount of Class B ore is to be treated.

Agitation.—The ore particles composing the pulp coming to the agitators are extremely quick-settling and largely granular; after only a few minutes' shut-down the pulp compacts solidly in the bottom of the agitator so that, mechanically, agitation is a difficult problem. At the Dome four Pachucas in series are in operation, but all the other mills use the Dorr agitator, which seems to be peculiarly adapted to the local requirements. From the trouble experienced in keeping the Hollinger pulp in suspension in the filter loading vats I judge that the Pachuca agitator is expensive in power required to prevent the filling up of the cone. With a trifling amount of power and a normal air consumption the Dorr agitator meets all the mechanical difficulties.

Metallurgically the quicker-settling particles need longer treatment than the lighter material. Selective agitation of the quick-settling particles is therefore essential if the best results are to be obtained.* The Dorr agitator, allowing as it does control over the rate of flow through the tank of material of greater or less than the average settling rate, meets the metallurgical requirements of the ore very nicely.

Filter Methods of the District Compared.—The Merrill filter is in use at the Dome, and while direct treatment in the presses has been tried, it has been found that the use of agitators for the dissolution of the precious metals is preferable, as a very large and expensive filter installation would otherwise be required. The Moore filter at the Hollinger has indicated that the ore contains such a large proportion of quick-settling material that vacuum filtration is not altogether satisfactory. In the loading vats, six air lifts are used, requiring 40 h.p. at the compressor, and even with this intense circulation the heavy slime accumulates on the 60 deg. hopper bottoms, resulting in such damage to the leaves that about one-third of the filter-operating cost is represented in repairs to filter leaves. Then, too, with the strong circulation, due to the air lifts, the cakes are channeled and uneven. On the whole, I do not consider that vacuum filtration is adapted to the Porcupine ore.

At the McIntyre mill, a Burt filter is doing very good work and is stated to have been entirely satisfactory. At the Hollinger and the McIntyre mills, the pulp from the new sections will be treated by continuous counter-current decantation, while the pulp from the original sections will continue to be put through the filters, so that shortly some interesting comparative figures on the two methods should be available.

Continuous Counter-current Decantation.—It has been previously mentioned that no oxidized ore occurs in the district, and the clean undecomposed rock breaks down to give an ideal product in the thickeners. Class A ore makes no colloid, and Class B ore, while grinding to an extremely fine, amorphous product, gives little trouble in settling, owing to its high specific gravity. Class A ore can be thickened to 30 per cent. moisture and Class B to 35 to 45 per cent., depending upon the percentage of concentrate. The critical moisture is 45 per cent., when 5 per cent. of concentrate is present, and about 35 per cent. moisture with Class B pulp, free from concentrate. On account of being able to get such unusually low moistures in the thickeners, a very high recovery of dissolved metals is possible by continuous decantation. Also, the fact that the cyanide strength of the solution from agitators to thickeners need only be carried at slightly above 1 lb. per ton favors the decantation system, where the mechanical loss of cyanide is generally higher than in ordinary filter practice. At the Porcupine Crown, with about \$13 going into solution per ton of ore and using four steps of decantation, with no filter, the dissolved gold loss is only 5c. and the mechanical loss of cyanide only 0.32 lb. per ton of ore.

The Hollinger mill put in two steps of continuous decantation early in 1913, and the complete counter-current decantation system was installed in the cyanide extension of the Porcupine Crown later the same year. Later still, the Vipond installed the counter-current decantation system, as did the McIntyre when the mill was enlarged. The Hollinger has a complete 300 ton plant under construction, and the Acme mill a 600 ton plant, both to use this system.

Mill Design.—The proper design for a mill treating Porcupine ore will depend upon the proportions of Class A and Class B ore to be handled. Unless there is to be a large excess of Class A ore, amalgamation may be dispensed with, as the recovery by amalgamation will not warrant its use. If Class A ore is in large excess it would still be an open question, but from a recovery standpoint amalgamation is unnecessary.

The Hardinge ball mill may not show up as well on Class A as on Class B ore, but I am inclined to think that it would. With an excess of Class B ore the ball mill will be superior to stamps. I am of the opinion that a cylindrical tube mill should be used for fine grinding, rather than a conical mill, if only for a theoretically better dissolution of coarse gold.

For the treatment of any considerable proportion of Class B ore, table concentration, with separate treatment of the concentrates, will probably pay.

Agitation should be arranged to be continuous, preferably in a series of flat-bottomed agitators, allowing a preferential treatment for the quicker-settling portion of the ore.

If filtration is used, a pressure filter will be more satisfactory than a vacuum filter; however, the ore is so perfectly adapted to continuous counter-current decantation that this would seem to be the proper treatment.

On account of the severe winter conditions and the high cost of fuel, the object to strive for in the design should be as compact an arrangement of the equipment as possible, so as to minimize the cubic area of buildings to be heated.

In the district, the water supply is ample, the sites for mills are good, and the facilities for convenient tailing disposal are adequate.

*For an exposition of the term "selective agitation," see the paper by J. V. N. Dorr, in Bulletin No. 92, p. 2072 (August, 1914).

PYRITIC SMELTING

At a recent dinner of the New York section of the Mining and Metallurgical Society of America, Mr. Robert Sticht, general manager for the Mount Lyell Mining and Railway Co., Queenstown, Tasmania, spoke informally of his experience in pyritic smelting in that country during the past 20 years. His remarks were discussed in an interesting manner by several members of the society. The following notes on the discussion are from an account published in the February issue of Metallurgical and Chemical Engineering.

Mr. Sticht said in part: "When I arrived at Mount Lyell the pyrite method was still a problem. I had enjoyed opportunity to carry it out in its purity, for short periods, whenever the ores were suitable, in Montana and Colorado, and had no fear, on an empirical basis, that it would not be possible to carry it on continuously where the ore was so favorable as at Lyell. But, for my own satisfaction in fully understanding what went on inside of a furnace, I was made general manager too soon. I then had to look after the pounds, shillings and pence, and investigations of metallurgy, as such, had to be postponed.

Briefly, we started with three blast furnaces in 1896 and then installed converters. This plant was gradually enlarged to six blast furnaces. A second plant was built with five furnaces. When we abandoned hot blast, after six years' use, we pulled down the first plant and did all the work in the second. This plant received an extra furnace in the course of time, so that it has six, but we usually run only three furnaces. The most interesting development, perhaps, was the discarding of hot blast. I do not think I would now recommend it under any conditions.

"Our furnace column reaches 18 ft. above tuyeres, and we use 64 oz. blast pressure. We base our work on the assumption that the inside of a furnace is occupied by a honeycombed mass of quartz, the passages of which are traversed by the blast and the molten sulphide, in opposite directions, the incandescent silica effecting simultaneous oxidation of the latter, by the oxygen of the blast, and the union of the FeO, thus formed, with the silica itself. This forms the slag, while the unoxidized portion of the sulphide makes the matte. Our matte runs from 45 to 50 per cent., rarely under 35 per cent., and sometimes as high as 60 to 65 per cent. (a 20.1 concentration). When the matte becomes too high, we reduce the siliceous ore; when too low, we increase the latter. The proportion of pyrites in the charge is constant; also the limestone. The only variables are siliceous ore and coke, but the latter is changed much less frequently than the former.

"As regards the percentage of coke used, I regret to say that the time when we got along with only $1\frac{1}{2}$ per cent. (and sometimes as little as 1-10 per cent., with hot blast) is now merely historic. We are now under the necessity of smelting more of the siliceous ore, and, at the same time, the iron and sulphur in the pyritic ore have diminished, owing to the inclusion of a little galena and zinc-blende and a little more gangue. As a consequence, we now employ from $3\frac{1}{2}$ to 5 per cent. coke, figured on the materials charged (except coke). The coke is our own make, but high in ash, and wet from the rainfall, which is 110 in. annually. Our slags are also more siliceous than they used to be, averaging 35 to 37 per cent. SiO_2, as against 30 to 32 per cent. in the past. The campaigns used to be three months or less; now they are a good deal longer, easily six months, the stoppages being caused by leaky jackets or the forehearth.

"Concerning shape of bosh, I am unable to see that it makes any difference. The furnace creates its own internal lines, which may be entirely different from those of the designer. One can alter the position of the smelting zone, i.e., the focus, by changing the blast. The focus can be driven up by increased blast, in fact it may be driven clear to the top of the column.

"You might think our works old-fashioned. We have kept fully in touch with all modern improvements and tendencies in the United States, but have not found that we could advantageously make use of the most striking ones. This is true as well of economic as of purely metallurgical points. Each furnace is run individually as regards momentary composition of charge, and the principal factor in their operation is the feeding. We have to be very particular about this, and cannot resort to mechanical appliances intended to serve unchanging average conditions of feed, because our process is so sensitive to variations in the relative proportions of silica, sulphide and air, and to the physical way in which these three come together. You cannot run a number of pyritic furnaces all in the same manner and obtain our present grades of matte with satisfactory constancy. You would have to reduce the grade to, say 20 per cent., and be satisfied to re-treat this."

Mr. D. H. Browne called attention to the fact that the practice outlined by Mr. Sticht was not applicable to all ores which contain sufficient iron and sulphur to smelt them. Sudbury ores, for example, containing 35 per cent. iron and 20 per cent. sulphur, are theoretically amenable to pyritic treatment, but many attempts had been made without success.

Mr. J. Parke Channing said: "About 15 years ago, when I was starting the operations of the Tennessee Copper Co., I heard of what Mr. Sticht was doing at Mount Lyell, in Tasmania, and Mr. Frank Klepetko kindly laid my problem before Mr. Sticht. He advised me that I had better not begin with pyritic smelting in Tennessee, but stick to heap roasting. We spent $70,000 putting in roast yards, then smelted the ore with 13 per cent. coke, making a 40 per cent. matte in the first operation, which was then converted. We made money, and everyone was satisfied. I fear that if we had started on pyritic smelting I might have made a failure of it.

"Shortly after this, Mr. Freeland, manager of the Ducktown Sulphur, Copper and Iron Co., whose property adjoined that of the Tennessee Cooper Co., began pyritic smelting. At first his slags were too siliceous, and to correct them he tried adding iron ore. This only made matters worse; and eventually, after pounding away at it and trying all the various combinations, he found that what was necessary was to cut down the coke and add silica. To him is due the credit for the pioneer work in pyritic smelting in the Ducktown district.

"Having the benefit of his experience, I took one of our 56 x 180 in. furnaces, ran the ordinary roasted ore charge down low, filled it up with the pyritic charge, with a minimum amount of coke, and the furnace ran perfectly. We found, however, that it did not make much better than 10 per cent. matte, which was then concentrated in a second furnace and bessemerized. We were soon able to clean up the roast yards and operate entirely by the pyritic method. Incidentally, we noted an increased extraction, as apparently some inexplicable loss occurred in the roast yards, which we

were never able to trace. We were never able to reduce the coke so far as Mr. Sticht did, nor were we able continuously to get so high grade matte as he. As the furnaces are now operated, the question of matte-fall is of secondary importance, the most important object being to produce a gas which can be used in the acid chambers for the production of sulphuric acid.

"The present aim is to yield a gas which will run about 6 per cent. SO_2 and 9 per cent. free oxygen, so that there may be enough oxygen to convert the SO_2 to SO_3, in the chambers. If the SO_2 is high, and the oxygen low, it will not do to add atmospheric air, because of the large amount of nitrogen thereby introduced, which dilutes the SO_2 below working requirements. The best way is to keep the coke down to a small amount, so that too much of the free oxygen will not be consumed in burning this carbon.

Experiments at Copper Cliff.

"For many years I had maintained to Mr. Browne that there was no reason why he should not smelt the Sudbury ores pyritically. He haunted the works of the Tennessee Copper Co. for over a year, trying to learn how to do it. About two years ago he engaged Mr. George A. Guess, who had been in charge of the Tennessee smelter, to try the experiment at Copper Cliff. Mr. Guess was given a furnace and blowing engine, and any kind of ore and flux that he wanted. After about three months I received two letters in the same mail; one from Mr. Browne saying that Mr. Guess had given it up, and the other from Mr. Guess himself saying that he could not smelt the ores pyritically and did not know why.

"I have grave doubts whether nickel-copper ores can be smelted pyritically. Possibly there is some peculiar characteristic of the nickel sulphide which prevents the pyritic action from taking place. In addition, a large amount of the silica in the Sudbury ore is combined as a bisilicate, and the conditions in the furnace are not suitable for breaking up this combination. There is just a possibility that in a very high furnace the desired result might be obtained, though I am of the opinion that Mr. Browne will have to continue with his roast heaps, for the present at least. There is a possibility that in the Knudsen furnace the problem may be solved. There, none of the materials can get away, and possibly the complicated reactions may take place."

Mr. Sticht was asked whether the difference in the action of the Australian and Sudbury ores might not be due to the fact that the former was a pyrite and the latter a pyrrhotite, the extra atom of sulphur in the former exercising a favorable influence on pyritic treatment. In reply, Mr. Sticht said that he believed there was a strong misconception regarding the utility of the extra atom of sulphur in pyrite as a source of heat in the pyritic process. This extra atom is not burned, but distilled. The FeS_2 turns practically to pyrrhotite at once, and even to something like Fe_5S_4 or Fe_4S_3 in the lower part of the furnace, and it is this particular sulphide which supplies the heat.

"In many ways, I think, a pyrrhotite ore is probably easier to smelt than a pyrite ore, but I may repeat that the most essential condition for the process is to have free SiO_2. What experience I had with pyrrhotite ores in Colorado made me feel that they were easier to treat than pure pyrites. In addition to keeping the throat more free, they seem to run hotter. But it was necessary not to be afraid to reduce coke, i.e., to a minimum which would ordinarily seem dangerous.

"One ought to have several feet leeway in the height of his smelting column. In reconstructing the Mount Lyell works, I raised the charge floor eight feet above the former one. A separate blower for each furnace is desirable if one can afford it, but that is only a minor point when there are not too many furnaces. When formerly using hot blast the stoves standing between blowers and furnaces, it complicated matters to have a blower for each furnace, and we did not do that at Mount Lyell. Our practice now is to supply about 20,000 cu. ft. of cold, free air per minute to each furnace. The 64 oz. pressure is only an incidental feature of the blast, and is due merely to the resistance encountered in forcing a given volume of air through a certain size of tuyere in a given time. Roughly speaking, it is volume rather than pressure that counts.

"Regarding the composition of our furnace gases, since the figures were first published, we have occasionally repeated the analyses, and still find practically no oxygen in the gases leaving the furnace, nor at a depth of 7½ ft. below top of the column. The determinations were last made a few months ago, with a water-cooled apparatus."

"The furnaces at Mount Lyell appear to be running with hot tops. This is due to the large amount of sulphur distilling off, which burns as it comes in contact with oxygen of the air above the charge. It is possible to run the furnace on matte and pyrrhotite with a satisfactorily cold top. On pyrites, however, this is impracticable, for this low temperature can be achieved only by operating in a manner which leads to rapid formation of crusts around the throat. We run, therefore, so as to avoid crusts, and thus appear to have a fiery throat. One must, however, not contemplate the combustion of the sublimated elemental sulphur, but judge throat conditions rather by the phenomena at the top of column. The top of the furnace is really not hot, for the pieces of charge glow slightly only around the walls, and are black and cold over the full inner area of the top. Between these cold pieces a whitish flame is visible, which changes into a heavy cloud of sulphur vapor a foot or two above the top of charge; this then ignites and forms the usual dense white smoke characteristic of the work. The furnace acts as its own crusher; all materials are charged in as massive lumps as the men at the mines and quarries can readily handle. Possibly, if we crushed them first, they would so decrepitate in the furnace that the latter would choke tight, and we could not practise pyritic smelting."

JAPANESE MINING EXHIBIT AT THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

In the Japanese exhibit, now being installed in the Palace of Mines and Metallurgy, all branches of mining will be represented by raw specimens as well as the finished product.

The exhibit, which is one of the largest individual showings in the building, covers about 7,500 square feet of floor space.

Built entirely by native workmen, the booths and kiosks are Oriental in style, and the same scheme is carried out in the furnishings.

One of the most interesting features of the exhibit is a large relief map of the Japanese mining region, done in colored clay.

Among the more important exhibitors are the Kaijima, the Japan Sulphur, and the Sumitomo Besshi Copper Mines and a number of valuable exhibits of coal, lead, copper and gold supplement the display.

WOULD STANDARDIZE SILVER.

The Mining and Engineering World, Chicago, states that at the recent meeting of the Colorado Metal Mining Association, held at Denver, a movement was started with the ultimate object in view of stabilizing the price of silver and making that metal a world standard. Under the leadership of T. R. Henahen, state mining commissioner, plans were adopted and a resolution drafted for holding a silver convention in Denver during the present year, the object of which will be to fix a standard price for silver and to arrange for an international convention at which free coinage of silver will be urged upon all the civilized nations of the earth.

Following is the resolution introduced by Commissioner Henahen and published in the Mining and Engineering World:—

Resolved, That the staggering cost of the war in Europe is depleting the treasuries and forcing governments to issue large amounts of paper money, which paper, together with the gold supply, will not be sufficient, and a demand must be made for a larger supply of coin. An international agreement of commercial nations to fix a standard price for silver is possible, practical, and necessary at this time.

The executive committee is directed to frame a bill calling for sufficient funds to defray the expenses of holding in Denver during 1915 a national silver convention, such as was held in St. Louis Nov. 26, 1889.

The governor of each state is empowered to appoint one delegate from each congressional district and ten delegates at large from the respective states and territories. The president is given the power to appoint ten delegates at large from each state.

The executive committee of this association is to be given power to appoint five delegates from each state and territory and five from the District of Columbia. It is recommended that the national convention appoint a committee, asking that the president and congress appoint an international conference, to meet before Sept. 30, 1915, in a convention with similar committees from all other civilized nations.

The purpose of the international convention will be to agree, if possible, upon some ratio between gold and silver, to the end that our mints be opened to the full and unlimited coinage of both metals.

DUTIES OF DIRECTORS.

John Pierpont Morgan, who took the witness stand before the United States Commission on Industrial relations, was asked by Chairman Walsh:

"To what extent are stockholders in a corporation responsible for the labor conditions in those corporations?"

"I don't think a stockholder has any responsibility," answered Morgan.

"What is the responsibility of a director for the conditions of the laborers?"

"The directors are not at all responsible, I should say.

"Who is responsible?"

"The officers of the corporation, the executive officials," answered Mr. Morgan.

Mr. Morgan said his chief duty as director was in receiving with other directors reports of the financial condition of the various corporations and reports on the business outlook.

SWEDISH IRON AND STEEL.

H.M. Legation at Stockholm reports that the Swedish Association of Iron Works (Svenska Jarnverksforeningen) published in its quarterly report figures of the output and export of Swedish iron and steel during the first three months of the war, from which it appears that exports of Swedish iron to some of the principal consuming countries considerably decreased, while the export to other countries entirely stopped. This decrease has to a certain extent been compensated for by the new markets that have been opened, while at the same time prices have remained firm. August was the worst month, the exports of iron and steel only amounting to 13.584 tons, as compared with 47,761 tons in August, 1913. These figures increased to 32.430 tons in September, and 34,210 tons in October, but even then they were very much less than in the corresponding months of 1913. This heavy decrease in exports naturally brought about a corresponding diminution of production, and during the three months July to September the output of pig-iron was only 140,300 tons, as compared with 175.800 in the corresponding period of 1913; blooms, 23,800 tons, as compared with 38,600 tons; Bessemer castings, 21,100 tons, as compared with 27,700 tons, and Martin castings, 90,900 tons, as compared with 119,900 tons.

NIPISSING.

It is expected that the annual report for the year 1914 of the Nipissing Mines Co. will show an increase in ore reserves as a result of the year's operations, notwithstanding a large production. The company distributed $1,200,000 in dividends during the year and increased the surplus about $400,000.

CANADIAN MINING INSTITUTE.

A meeting of the Toronto Branch of the Canadian Mining Institute was held at the Engineers' Club on Saturday, Feb. 6, at 1.15 p.m.

The chief topic of discussion was the question of nickel export. Numerous arguments in favor of and against a prohibition of export of nickel matte were presented.

The next meeting of the Toronto Branch will be held on Feb. 27.

CALUMET AND HECLA.

Houghton, Mich., Feb. 5.

Employees at Calumet and Hecla mines, mills and smelters, Isle Royale, North Kearsarge, Allouez and Ahmeek go on full time this week. This affects 10.000 men and adds 20 per cent. to output of all these mines.

MINERS AT THE FRONT.

Miners who have gone and those who are going to the front will be relieved from the obligation to work their claims so many months in each year and the claims will be kept open for them. Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines announced this decision last week. The miners also will be relieved from paying their licenses.

Hedley Gold Mining Co.—The Gazette, published at Hedley, Similkameen, states that the motors and new compressors for this company have been received and are being installed in the new power house. The motors are of 400 and 440 h.p.; they will be used to drive the compressors. The new compressor is a Rand engine, similar to the one put in here several years ago.

A LABORATORY SAMPLER

By J. T. King*

During the past year the writer has built and tried out a mechanical sampler, especially adapted for finely ground ore. It operates on a principle somewhat different from that of other samplers. As it has proved to be very satisfactory, a description may be of interest especially to those interested in sampling operations. Before explaining the features of the apparatus a few of the conditions which influenced the writer to construct the same will be given.

The sampling of large lots of ore is carried out by hand methods or by mechanical ones, and there usually comes a stage in the latter when hand sampling is resorted to. The reasons for favoring the hand methods in the final stages of the sampling are not clear. It is maintained by some that after a certain stage in the reduction, more accurate results are obtained by these hand methods, coning and quartering, riffles etc. Provided this is so it can only be because a suitable mechanical sampler for finely ground ore (as it would be in the final stages of sampling), is not available. That is, the reason for using these hand methods is due to necessity rather than to choice. Experience has shown that whilst properly constructed mechanical samplers will consistently give uniformly good samples, in season and out of season barring accidents, the accuracy of hand samples depends so much on the personal equation and vagaries of the performer as to be often open to doubt and suspicion.

In principle, mechanical methods are an approach to the ideal condition, the elimination of the personal element which is ever present in hand methods. From the psychological point of view hand methods are wanting. A machine has no judgment, no conscience; but it has methods due to its construction. It has no interest in the ultimate assay of the sample, whereas the hand sampler may have, and unfortunately sometimes is influenced prejudiciously by this interest. Hand work offers possibilities of introducing fraud discrimination and bias in favor of either buyer or seller as the case may be. With the most honest intentions a man may be too fair. He may be truly impartial in his motives; but quite partial in his methods. Sampling should be performed in a mechanical manner, so that judgment does not conflict with the so-called laws of chance. It is nigh impossible to teach men the importance of adherence to the rules and details, so necessary in hand sampling. Does it not seem that the introduction of mechanical methods offers a means of placing the sampling of ores on a more ideal basis?

Generally speaking the assayer is not responsible for the accuracy of the sample submitted to him for assay. He is expected to determine its contents and to report the same. But the report of the assayer is used as a criterion of the value of the original lot of ore that has been sampled. And if the results are higher or lower than were anticipated, the discrepancy is often ascribed to poor assaying, when quite often the error is due to poorer sampling. The most careful and painstaking assaying will not produce the correct value of an ore if the sampling has been improperly performed.

In the Assaying Laboratories of the Department of Mining Engineering in the University of Toronto, emphasis is laid on the accuracy expected in the students' assays. Assays are repeated until satisfactory results are obtained. It is only fair then that true samples be submitted for assay. Random ones will not do. In the past the bag samples of pulp submitted to the classes for assay were selected from the original ores by hand methods, usually by riffles. It is a difficult matter to cut several samples from a lot of pulp by hand methods, and have them agree closely in value among themselves. Those with most experience will testify to this. As an ore sample when returned by a student after assay, is not given out again to another student, thus eliminating any excuses that the sample had been salted by the other student, it is necessary to prepare several thousand individual samples each year. The labor of this undertaking and the time required, will at once be evident to anyone who has say, cut lot of pulp into 32 samples by a riffle sampler, or worse still by coning and quartering.

Aside from the tediousness of sampling down to halves, to quarters, etc., until 32nds or 64ths are obtained, the introduction of the numerous pans offer sources of error due to salting. The whole operation is dusty, tedious, and conducive to bad temper rather than to good sampling.

Further, the assays of students, working on several samples from the same ore often did not agree as they should. Beginners might be excused for discrepancies; but with advanced students close agreement should be obtained. Cases occurred where good students repeated their assays, and got the same disagreement. Sometimes a student with a higher or lower result than his more fortunate fellows felt that the fault was probably not his; but due to the sampling that had been done for him. In other words he believed that the sampling error might be greater than his, and it was sometimes difficult to convince him otherwise. Since the whole object in doing the sampling for the students was to localize possible errors directly to the assaying, it was apparent that a more satisfactory sampling method must be devised, and due to the objection stated it was decided to try some mechanical method.

As no sampler was known that would divide a lot of ore into more than four parts at one operation, it was necessary to build one especially for our purposes. Several means of dividing an ore suggested themselves, and on attempting to test these a real and unexpected difficulty was found. The simplest way to sample mechanically is to cut the samples from a falling stream of ore, and this method was tried. While it may be a fairly easy matter to run lump ore at a fairly constant rate from an inclined hopper, 100 mesh pulp behaves quite differently. It was soon learned that the pulp must be dry to run at all. To give a stream of pulp uniform in cross section, a conical funnel with a small hole at the apex was used for a hopper. It was soon found that the hole must be at least one inch in diameter to give anything like a steady feed. The pulp runs for a short time; but soon a circular wall forms in the pulp, surrounding the central space where the pulp has run from. Agitation by tapping the funnel was a help; but the pulp ran only spasmodically, and a one inch stream was too large for two or three pound lots of pulp such as it is often necessary to sample. By placing an inclined trough under the hole and agitating it back and forth, it was found that streams of pulp as small as one-eighth inch in diameter could be run continuously. The vibration of the pulp in the trough is apparently transmitted to the pulp in the funnel above, loosening it up and thus preventing the packing of the

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pulp or the formation of a circular wall with a central space. Fig. (4) will illustrate this more clearly.

Having obtained a method of inducing the pulp to flow in a steady, uniform small stream, the next question was how to sample the stream, the primary object plers, the sample compartments passing through the stream at right angles, at regular intervals. They act on the whole of the stream part of the time. With the bags thus arranged in a row, it was necessary to move them back and forth, and as the speed could not be kept

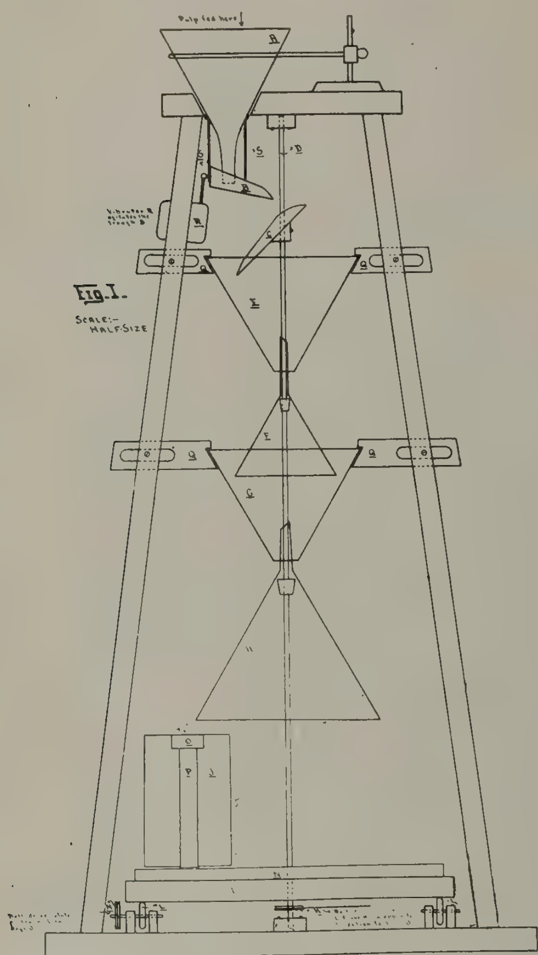


Fig. 1

Fig. 2

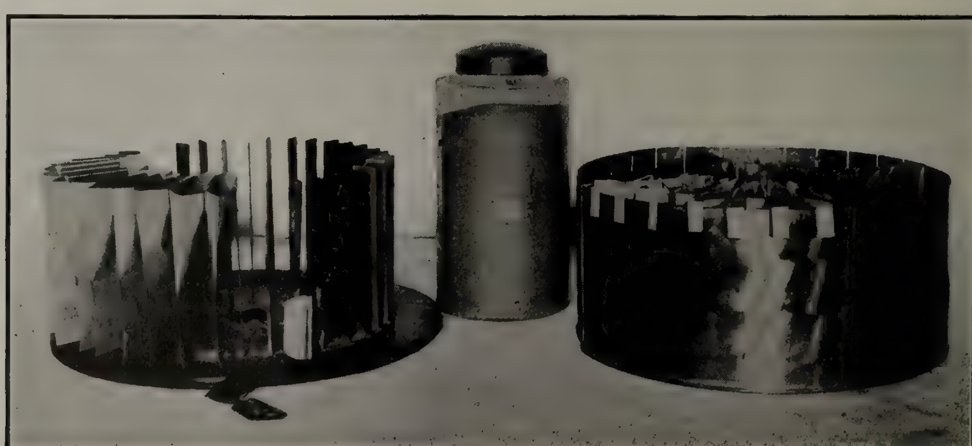


Fig. 3

A LABORATORY SAMPLER

being to obtain a large number of individual samples, rather than one or two, as is usual. The first method tried was to pass 32 paper bags, arranged in a row, back and forth in a horizontal line under the stream. This is practically what is done in all mechanical sam- uniform, especially near the ends, all the bags did not get their proper proportion of the pulp. Arranging the bags in a circle overcame this difficulty. Much dust and spilling of pulp was caused by the bags passing through the stream, and it was considered that not

enough cuts were made to give good samples. Either the bags must travel very fast, thus increasing the dust and spilling, or the stream must be so fine as to make the process monotonously long.

The next step was to let the pulp stream fall onto the apex of an inverted cone, the pulp rolled down the sides, and was caught in bags arranged around the base. Next the oven was revolved in one direction, and the bags in the opposite direction, to counteract any tendency of one part of the feed always going to the same bag. This was the vital departure from the usual machanical method of sampling. The usual stream was spread over the cone and fed into all the compartments at once, rather than to one compartment at a time. And note, each compartment does not obtain its feed from but one part of the stream, but from all parts in an impartial manner. This method of sampling was such an advance on others that it was adopted. Minor defects of a mechanical nature were corrected until the apparatus took the form shown in the illustrations.

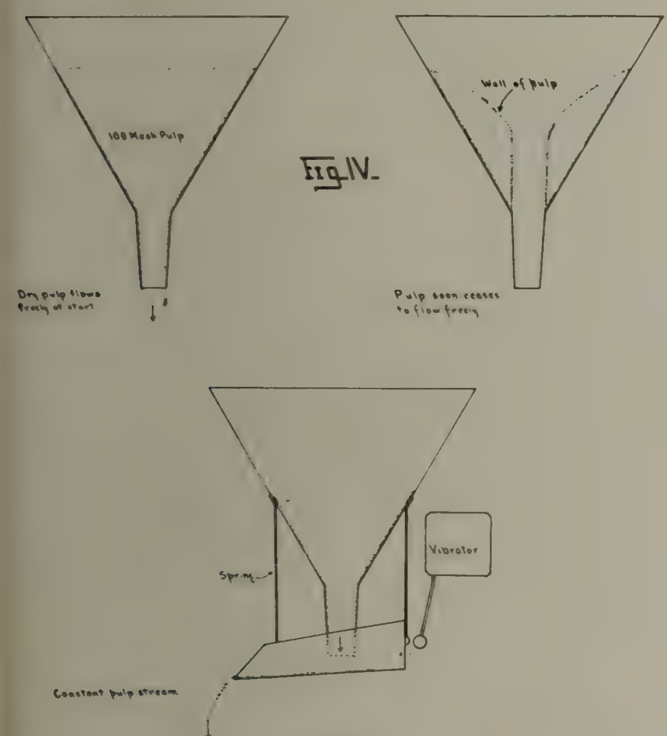


Fig 4

Fig. 1 is from a photo of a diagrammatic drawing, showing the method of feed more clearly. Pulp is fed into the funnel A at the top, the neck of which enters a trough B. A vibrator R, agitates this trough, and also the funnel through springs S. This agitation causes the pulp to flow in a continuous stream onto a scoop C. This scoop is rigidly attached to a central rod or axis, which also supports glass funnels H and F, resting on rubber corks. This axial rod is rotated by a belt on a pulley H near the base, thus rotating the scoop C and funnels F and H in the same direction. E and G are glass funnels with necks cut off, resting on adjustable supports Q. I is a platform supported on three rubber tired wheels L, and held in position by the axial rod passing through its centre. This platform is rotated in the contrary direction to the funnels and scoop, by a belt on a pulley M, which turns one of the supporting wheels L. The bags or other containing devices are placed in a circular row on the platform I. Thus pulp fed at A falls onto C, E, F, G and H in succession, and is caught in the rotating bags. A couple of batteries operate the vibrator, and a one-eighth h.p. motor supplies ample power for steady rotation.

The original method of supporting the paper bags is shown in the photo of the sampler Fig 2, and at the left of Fig. 3. On each of two boards which form a circle, were spaced seventeen upright brass strips. Between these the paper bags were placed and held in position by clips as shown. The number of bags, 32, was chosen due to the various combinations of samples that could be made. Thus combining alternate bags gave sixteen samples. The original parcel of pulp could in this way be divided into 1/32, 1/16, ⅛, ¼, or ½.

A better form of container is shown at the right of Fig. (3) and in Fig. (5). Four brass boxes are segments of a circular ring, the inner and outer walls being the width of a sample bag apart. The upper edges are slotted at regular intervals, and brass strips are inserted in these slots. If it is desired to cut a lot of pulp into four samples, it is run direct into the boxes. Thirty-two bags can be placed between the strips, and held in position by clips over the overturned edges. Again if only one sample is desired only one bag is used, the reject falling into the boxes. This form of container is now used entirely in preference to the first form.

Now let us examine the underlying principles of the apparatus, with reference to the general philosophy of sampling. The element of chance is ever present in all sampling operations. We must sample and must combat chance. In the long run chance is a fair master, and follows the law of averages. In sampling, the more impartial chances taken, the more likely is it that the high and low deviations from the true value will cancel each other, and the average of the sum of the errors be zero. In sampling the object is to eliminate the probability of errors not balancing. The law of averages cannot safely be depended upon to compensate for the individual errors, if too few averages are taken.

If there is complete impartiality in the method by which the particles fall into their respective lots, then a proper balancing of possible errors will be the result. In this sampler the free flow of particles is spread out into a thin stream, which revolves in one direction while the bags revolve in the other. Each bag takes a minute bite absolutely uniformly, out of each part of the stream, and takes a great many of these bites, so that we have not only impartiality, but a great many chances for any possible errors that might possibly occur to balance each other.

Mechanical samplers either act on a part of the ore stream all the time, or on all of the stream part of the time, the latter type being considered the better. Any sample compartment of the laboratory sampler acts on a part of the stream all the time. The objection to sampling one part of a stream all the time is that an ore stream is not constant in value across its width. But here the stream of pulp from the feeder is fairly distributed to the funnels, and is spread out into a circular ring at the base of the lowest funnel. The sample compartments pass through this feed in cyclic order and are always in the stream. Each compartment selects from all parts of the stream impartially, at regular intervals, rather than from one part of the stream all the time, or all of the stream part of the time. The advantage of this method of selecting the small bites is at once apparent.

The jar of pulp shown in Fig. (3) contains 9,000 grams. Ordinarily this amount would be sampled in about ten minutes, though the time can be varied by adjusting the vibrator tension. A bag would obtain about one-half gram of pulp each second. The funnels revolve about sixty times each minute, in the opposite direction to the bags, which revolve about thirty times each minute. Hence a bag passes all parts of the lower edge of the funnel one and one-half times each second, in obtaining one-half gram of pulp, or one-third of a gram each revolution. Of course the pulp selected per revolution can be varied at will; but this rate gives samples that can be banked on.

An attempt to test the accuracy of the sampling was made. To do this is not as easy as it might appear. The only fair way is to test the whole of each product delivered, as sampling a sample by another method would introduce errors not chargeable against the sampler. Further the errors of any scheme of assaying the products would not be the fault of the sampler. Two kilograms of limestone were placed on top of the same weight of silica in a box, both were finer than eighty mesh. This was fed to the sampler without any attempt at mixing. From 32 samples 8 were selected at random, and each was tested for insoluble matter in the standard way, the whole of each sample being treated. The results of this test are given in the adjoining table, and are not to be interpreted as a yard stick to measure the absolute accuracy of the sampling, owing to the reasons stated, but rather as showing the

Fig. 5

agreement that still obtains after the errors due to the analysis have been introduced. The extreme variation between high and low is less than one in seven hundred.

No. 1, 55.74%; No. 2, 55.72%; No. 3, 55.67%; No. 4, 55.74%; No. 5, 55.73%; No. 6, 55.68%; No. 7, 55.70%; No. 8, 55.71%. Average, 55.71%.

The sampler was constructed out of material available about the laboratory, such as glass funnels, corks, vibrator, brass rod, motor, etc. It is so constructed that it can be readily taken down in case of injury to the funnels. Outside of the motor and the brass containers, the parts are comparatively cheap. Very little dust is created during the sampling, and any remaining on after sampling is easily brushed or blown off. Arranging the bags, sampling and cleaning for the next run will average 15 minutes. An attendant in one afternoon of four hours sampled 16 jars of pulp into over 500 samples of around 200 grams. Any range from 1 to 32 or more samples are delivered, and the sampler is easy to operate and keep in order. Arrange the bags, fill up the funnel with pulp, start the motor and vibrator, the sampler does the rest.

And above all other advantages claimed, the marked improvement in the assaying done by the classes is ample reward for the time spent on the sampler. The psychological effect on the students is good and is plainly to be seen. They have taken increased interest in their assaying, and excuses have been eliminated. The sampler is so evidently beyond suspicion that the students see at once that any errors must lie in their work, and that it is up to them to get good results. Furthermore it is not a case of comparing results with some standard result made by the staff in a previous month or perhaps previous years, but it is a comparing of student with student, on a product that is unquestionably beyond suspicion or criticism.

RECENT PUBLICATIONS OF THE MINES BRANCH

The Mines Branch has published bulletins by John McLeish, Chief of the Division of Mineral Resources and Statistics, on Production of Iron and Steel, 1913 and on Production of Cement, Lime, Clay Products, Stone, and other Structural Materials, 1913.

Iron and Steel.

Statistics of iron ore and of pig-iron and steel production in 1913 show increased shipments of iron ore from Canadian mines, an increased production of pig-iron and steel in Canadian furnaces and steel plants, and an increase in the imports of most classes of iron and steel products, but the general relationship of domestic iron ore supplies to furnace requirements exhibits no important change from the conditions that have obtained for a number of years past. Canadian furnaces continue to be operated almost entirely on imported ores, and Canadian iron and steel plants supply probably less than 30 per cent. of the present consumption.

Structural Materials and Clay Products.

The subjects included under this heading comprise, in the order treated: cement; clay products of various kinds, such as brick, sewerpipe and tile, pottery, etc., lime; sand-lime brick; sands and gravels; slate, and stone for building and other purposes, including granite, marble, limestone, sandstone, etc. Previous to 1912 no attempt had been made to collect a record of the production of sands and gravels in Canada, and the only statistics available were those of exports and imports. In 1912, however, a beginning was made in the collection of these statistics; but owing to the incompleteness of the available lists of producers and the failure of many to answer correspondence, only a very partial record was obtained. In 1913 the scope of the collection was extended to cover sands and gravels used by railways for ballasting, etc., but at the time of closing the statistics several important and comprehensive returns had not been received. The statistics of stone production do not include the stone used in making cement or lime, but are as complete as possible for all other established stone quarries; nevertheless there is undoubtedly a large production of stone for foundation work, road-making, and railway construction of which no record is available.

The total value of the production of these structural products in 1913, according to the record obtained, was $30,809,752, as compared with a value of $28,794,869 in 1912, an increase of $2,014,883, or nearly 7 per cent. The total production in 1911 was valued at $22,709,611, compared with which the 1912 production showed an increase of $6,085,258, or 26.8 per cent. The total production in 1910 was valued at $19,627,592, and in 1909 $16,533,349.

ANNUAL REPORT, HOLLINGER GOLD MINES, 1914

The fourth annual report of Hollinger Gold Mines, Limited, has just been issued. It covers operations during 1914.

President N. A. Timmins says in part:

While the production of gold during the year 1914 has shown an increase of only $222,134.56 over the production for the year 1913 (an increase of approximately ten per cent.), the improved condition of the property as a whole, has been very marked. The 1914 output has been attained without undue exertion, a statement which could hardly be made of the outputs of previous years, and not only has the output been increased with comparative ease, but at the same time the amount of new ore developed has added greatly to ore reserves.

The gold won in 1914, namely $2,688,354.80, was the result of milling 208,936 tons of ore, and the gross profits from our operations amounted to $1,786,679.66, this latter amount being almost exactly two-thirds of the total values recovered.

From the gross profits must be deducted the amount of the depreciation which has been written off plant, namely $165,621.11, and a subscription of $10,000.00 to the Canadian Patriotic Fund, thus leaving the net profits at $1,611,058.55. The net profits have been accounted for, first by the disbursement of $1,170,000.00 in dividends to shareholders, and secondly by a net addition of $451,058.55 to surplus. Particular attention is directed to the details of the make up of the surplus account as it stood at the beginning of the year. The total surplus carried forward to the new year is $1,-126,743.11 and of this amount $664,603.48 is in the form of cash and gold. The balance of the account is made up of plant and development work, which items are valued at approximately seventy per cent. of their actual costs, a fact which demonstrates the conservative nature of the accounting. A subscription of $10,000.00 to the Canadian Patriotic Fund has been noted above, and it gives your directors pleasure to state that apart from this company subscription, the employees have independently subscribed approximately $3,000.00 to the above fund.

Expenditures for plant amounted to $305,621.11 during the year, and, while the amount is large, yet it is justified by the greatly increased capacity of our mining and milling plants. When the present additions to the mill are completed we shall have increased our milling capacity from 500 tons per day to 1,600 tons per day, a very decided expansion.

Development work was also a heavy charge during the year, but with the great increase in milling capacity it has been necessary to put the mine into shape to supply the increased demands for ore.

The results of milling 208,936 tons of ore have shown an average value of $13.67 per ton. The average value of the ore reserves, estimated at the first of 1914, was $13.71 per ton, hence it is obvious that no attempt has been made to select the higher grades of ore.

Good progress has been made towards a solution of all metallurgical problems, and our milling practice has kept pace with the most modern developments, although we still adhere closely to the lines of practice originally installed.

The matter of working costs has received strict attention during the year, and the promised reduction to $4.50 per ton has been fully realized, the costs for the year (exclusive of depreciation), amounting to $4.42 per ton. It is expected that improved conditions will enable a still further reduction to be made during the present year, and it is the hope of the management that before the end of the year, a cost of $4.00 per ton will be reached.

It is interesting to note that although a reduction in operating costs has taken place, it has not been at the expense of our employees, for not only are we paying the highest scale of wages, but we are also disbursing considerable amounts in the form of bonuses to men, for loyal services.

Mining operations have progressed without interruption, and our position as regards the physical condition of the property is very strong. Underground development has increased the estimated value of developed ore reserves from $11,604,800.00 at the beginning of 1914 to $13,358,420.00 at the beginning of 1915. Diamond drilling has shown that there is no change in the characteristics of the ore bodies at a depth of 1,500 ft., and the directors can assure shareholders that they know of no reason why the persistence of ore should not continue to much greater depths.

The attention of shareholders is directed to the fact that only a small number of the veins known to exist upon the property have been opened up at all, and while not wishing to appear over sanguine, we do commend to shareholders a careful study and consideration of that portion of the general manager's report dealing with the possibilities of the future, it being our firm belief that the known facts merit a most liberal interpretation.

After four years of extensive development, the general manager is able to report a continual opening up of new ore bodies, and there is significance in his statement that "there have been no disappointments of any kind in the mine during the past year."

Shareholders have already received notice of the increase in dividend rate from 39 to 52 per cent. per annum. The condition of our surplus account, the reserve of broken ore in the mine, and the ability to mill increased tonnages, are conditions which make the payment of increased dividends advisable. It is possible that during the first few months of the year the larger dividends will interfere with the addition of any substantial sums to the cash surplus, owing to the fact that earnings not required for the dividends will be required for completing the extensions now being made to the mill and cyanide plant. By the end of April the heavy expenditures for plant should be about finished, and during the balance of the year the surplus account should show a regular increase.

It has been necessary to keep pace with the growth of mining and milling operations by increasing and improving the living accommodation for our employees. The thriving town of Timmins, which has been provided through the efforts of Canadian Mining & Finance Co., Ltd., is now caring for most of our men and their families. About 150 single men are still quartered at the mine bunk houses, but all others find accommodation in the town. The provision of a safe water supply was imperative, and in order to secure funds for the installation of the necessary waterworks, the town of Timmins has issued $95,000 of waterworks debentures. These debentures, which were all subscribed for at par by Hollinger Gold Mines, Ltd., bear interest at the rate of six per cent. per annum and run for two different terms, one lot of $50,000 being repayable in annual instalments extending over ten years, and a second lot amounting

to $45,000 over fifteen years. Payment of the first instalment has reduced this investment to $89,273.28. The debentures are authorized under the Ontario Trustee Act and have been validated by the Ontario Railway and Municipal Board. Considering the vital interest which we have in securing a good supply of water, they constitute a most proper investment for a part of our surplus funds.

It is a pleasure to your directors to review the experiences of the past year and to enumerate the gains which have been made, but this pleasure is tempered by regret over our great personal loss caused by the death of our fellow director, Mr. Duncan McMartin, whose untimely demise before reaching his prime, while most keenly felt by his co-directors, was also much regretted by many of our shareholders, to whom he was known as a warm personal friend. The vacancy on the Board thus caused was filled by the election of Mr. John B. Holden, who has been the company's counsel and solicitor since its organization and who is also an executor of the late Mr. McMartin's will.

Your directors would be unmindful of their simple duty if they omitted to express their unstinted praise for the efficient services of the general manager and of his most capable assistant, Mr. A. R. Globe, assisted as they were by the praiseworthy efforts of a loyal staff.

Balance Sheet, Dec. 31, 1914, Hollinger Gold Mines, Ltd.

Assets.

Capital Expenditures—			
Mining properties			$2,500,000.00
Plant. Brought forward from 1913		$500,000.00	
Additions during 1914		305,621.11	
		$805,621.11	
Less depreciation for 1914		165,621.11	
			640,000.00
Development. Brought forward from 1913		$175,000.00	
Additions during 1914		24,862.17	
			199,862.17
Deferred development charges			123,688.32
Town real estate			2,950.00
			$3,466,500.49
Current Assets—			
Cash on hand and in banks		$370,468.44	
Debentures, Town of Timmins		89,273.28	
Accounts receivable		21,163.68	
Materials and supplies on hand		117,949.34	
Insurance and charges paid in advance		4,278.09	
Guarantee deposits		500.00	
			603,632.83
Bullion Assets, etc.—			
Bullion shipped, not paid for		84,961.76	
Bullion on hand		89,000.00	
Solutions on hand		24,700.00	
Precipitates on hand		2,700.00	
Litharge, slags and miscellaneous		3,500.00	
			204,861.76
			$4,274,995.08

Liabilities.

Capital stock			$3,000,000.00
Current Liabilities—			
Wages unpaid		$53,024.81	
Accounts payable		69,694.41	
			122,719.22
Contingent liabilities			15,532.75
Subscription to Patriotic Fund			10,000.00
Surplus—			
Premium on shares sold, re-invested in plant as per 1913 Annual Report		$144,248.44	
Less written off 1914 plant (part only)		144,248.44	
Profit and Loss Account—			
Forward from 1913	$ 544,214.36		
Less adjustments	2,778.24		
		541,436.12	
Profits Jan. 1st to Dec. 31st, 1914		1,786,679.66	
		$2,328,115.78	
Less Patriotic Fund subscription	10,000.00		
1914 plant depreciation, not shown above	21,372.67		
Dividends paid, 1914	$1,170,000.00	$1,201,372.67	1,126,743.11
			$4,274,995.08

General Manager P. A. Robbins says in part:

Capital assets have been increased by:

Plant additions	$305,621.11
Development	24,862.17
Deferred development	123,688.32

The expenditure of $305,621.11 for plant is shown below. No explanation of this item is necessary, the expenditures being the natural outcome of increased operations.

Expenditures for plant and equipment during 1914 were distributed as follows:

Dwellings.		
Town cottages	$ 416.97	
Mine dwellings	2,252.30	
Mine bunk houses	7,290.62	
Mine boarding house	1,007.53	
		$10,967.42
Plant Buildings.		
Stamp mill	$45,364.16	
Cyanide plant	28,062.70	
Change house	4,755.26	
Crusher house	1,237.04	
Scrap store	705.87	
Shaft house	341.64	
Office	217.12	
Carriage shed	238.43	
Miscellaneous	317.73	
		81,239.95
Camp equipment		2,012.24
Equipment.		
Cyanide plant	$52,564.71	
Stamp mill	50,184.08	
Fire sprinkler system	51,955.25	
Water supply system	13,171.83	
Mine equipment	18,317.17	
Electrical plant	5,585.26	
Crusher, conveyor	2,373.52	
Machine shop	3,131.39	
General plant	7,443.41	
Oil tanks and pumps	2,668.53	
Hoisting plant	2,244.46	
Surface air lines	771.36	
Office furniture	785.08	
Miscellaneous	205.45	
		211,401.50
Total		$305,621.11

Development amounting to $24,862.17 was added to the amount (175,000.00) brought forward from 1913, thus bringing the total to $199,862.17. This is work of a permanent character which need not be charged off against operations until the mine begins to show reduced tonnages in the ore reserves.

"Deferred development" consists of the work of blocking out the ore, and preparing new levels for the regular operations of production. There is also a certain charge per ton carried against the gradually increasing reserve of broken ore. This reserve consists of ore upon which all mining operations have been completed, with the exception of tramming and hoisting to the surface. As a matter of policy it is our intention to continue to build up this reserve until we have enough broken ore available to insure the operation of the mill at full capacity over a considerable period of time, thus providing against any contingency which may interfere with regular mining operations.

The loss of interest upon the capital tied up in this broken ore reserve is more than offset by the strengthening of our position in the event of any future labor troubles.

The combined charges being carried in "development" and "deferred development" accounts, amount

Distribution of Working Costs, Hollinger Mine.

Account	Labor	Stores	Other Charges	Total	Per ton of Ore Milled
General charges	$32,602.41	$ 8,567.00	....	$ 41,169.41	.197
Administration and management	40,200.00	10,584.83	....	50,784.83	.243
Taxes	....	....	43,716.58	43,716.58	.209
Insurance	....	....	19,887.55	19,887.55	.096
Clearing surface, roads, etc.	6,147.17	370.23	....	6,517.40	.032
Operating camp	11,746.51	14,844.04	....	26,590.55	.128
Operating boarding house	572.87	9,438.76	....	10,011.63	.048
Mining—					
Exploration	5,186.99	6,420.90	....	11,607.89	.056
Development	55,790.08	28,514.72	....	84,304.80	.403
Production	228,035.28	116,513.41	....	344,548.69	1.646
Milling—					
Operations	101,080.06	146,686.73	....	247,766.79	1.184
Alterations	2,826.52	4,465.56	....	7,292.08	.035
Alterations to plant	3,275.65	504.23	....	3,779.88	.019
Marketing bullion	....	....	12,204.25	12,204.25	.059
Fire protection	1,171.77	3,057.24	....	4,229.01	.021
Prospecting	406.15	....	....	406.15	.002
Loyal service bonus	....	....	8,935.25	8,935.25	.043
	$489,041.46	$349,967.65	$84,743.63	$923,752.74	$4.421
Depreciation—					
Written off plant				$165,621.11	.792
Grand total of costs				$1,089,373.85	$5.213

This statement is self explanatory and shows a total net working cost of $4.421 per ton, to which has been added a cost of $.792 per ton to cover the amount written off plant for depreciation, thus bringing the total up to $5.213 per ton. In last year's report the figures were $6.11 per ton, net, and $6.97 per ton, gross costs.

to approximately twenty-seven cents per ton, when spread over the tonnage given in the "estimate of ore reserves."

"Materials and supplies on hand" are carried at $117,949.34, this comparatively large amount being due to stocking up with chemicals, pebbles and other supplies, at the outbreak of hostilities in Europe. A certain amount of plant is also being carried in stock which will be used presently in the new extensions to the mill and cyanide plant.

"Bullion assets" are self explanatory and are about normal in amount.

Under liabilities, the item "contingent liabilities" appears. These are deferred liabilities made up of balances which will be payable to certain manufacturers of machinery when they complete their contracts with us.

The item "premium on shares sold" appears for the last time in the balance sheet. It will be recalled that 50,000 shares of treasury stock were sold in 1912 at a premium of $250,000. The whole amount realized from the sale of shares was used for the purpose of completing plant, and it is only right that the amounts written off of plant should be applied to retiring this liability from our books. This has now been accomplished and our sole capital liability consists of the $3,000,000 capital stock of the company.

Hollinger Mining Costs, 1914.

The following table shows the distribution of the costs of mining:—

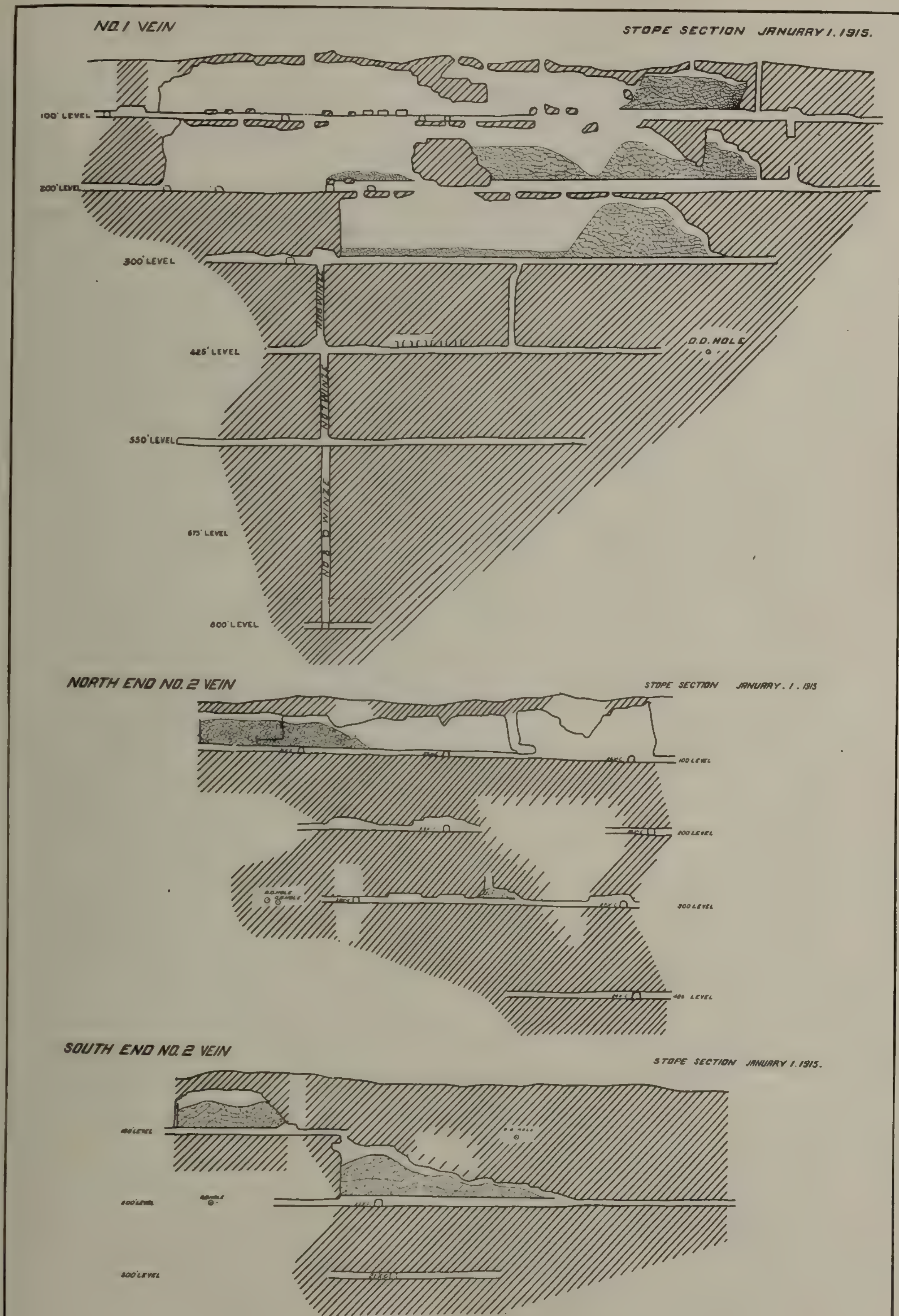
Account	Labor	Stores	Total	Per ton of Ore Milled	Per ton of Rock Broken
General mining charges	$ 4,361.23	$ 2,186.92	$ 6,548.15	$0.031	$0.022
Superintendence	14,454.14	....	14,454.14	.069	.050
Diamond drilling	5,186.99	5,824.48	11,011.47	.053	.038
Cross-cutting	9,298.67	12,206.39	21,505.06	.103	.074
Shafts	6,722.94	3,700.69	10,423.63	.050	.036
Drifting	38,323.48	35,176.38	73,499.86	.352	.254
Raising	2,457.23	2,930.45	5,387.68	.026	.019
Winzes	4,531.34	1,984.17	6,515.51	.031	.022
Tramways	788.23	950.43	1,738.66	.008	.006
Timbering Shafts, Winzes, Raises	3,678.05	5,608.27	9,286.32	.044	.032
Stoping	90,818.54	63,994.73	154,813.27	.741	.534
Scaling	3,240.29	....	3,240.29	.016	.011
Timbering drifts and stopes	20,235.74	9,065.48	29,301.22	.140	.101
Track laying	4,477.29	2,333.07	6,810.36	.033	.023
Tramming	84,884.66	1,876.75	86,761.41	.415	.300
Pipe-fitting underground	3,217.00	4,078.74	7,295.74	.035	.025
Mine drainage	2,807.21	4,097.25	6,904.46	.034	.024
Hoisting	29,638.09	11,370.40	41,008.49	.196	.141
Landing and dumping	8,317.86	5.42	8,323.28	.040	.029
Drill repairs	2,092.46	12,166.74	14,259.20	.068	.049
Sharpening steel	16,550.66	4,154.36	20,705.02	.099	.071
Collecting steel	8,066.50	45.69	8,112.19	.039	.028
Mine sampling	5,285.12	166.96	5,452.08	.026	.019
Assaying	885.53	460.66	1,346.19	.006	.005
Change house	916.67	1,043.25	1,959.92	.009	.007
Surveying	1,864.78	735.19	2,599.97	.013	.009
Mine lighting	374.80	4,511.33	4,886.13	.023	.017
	$373,475.50	$190,674.20	$564,149.70	$2.700	$1.946

Recapitulation of Mining Costs.

Account	Labor	Stores	Total	Per ton of Ore Milled	Per ton of Rock Broken
Exploration	$ 5,186.99	$ 6,420.90	$11,607.89	$0.056	$0.040
Development	55,790.08	28,514.72	84,304.80	.403	.291
Production	228,035.28	116,513.41	344,548.69	1.646	1.188
Deferred development	64,188.53	33,144.79	97,333.32	.467	.336
Broken ore reserve	20,274.62	6,080.38	26,355.00	.128	.091
	$373,475.50	$190,674.20	$564,149.70	$2.700	$1.946

The following figures show a comparison of expenditures for mining, in the two years 1913 and 1914:—

	Exploration		Development and Deferred Develop.		Production.		Total.	
Year	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1913	$13,230.59	$0.096	$137,375.38	$0.993	$274,688.23	$1.986	$425,294.20	$3.075
1914	11,607.89	.056	207,993.12	.998	344,548.69	1.646	564,149.70	2.70



Stope Sections, Hollinger Mine, showing condition of orebodies on No. 1 and 2 veins, Jan. 1, 1915

Underground work was hampered during a greater part of the year by an insufficiency of compressed air for operating drills, but better progress has been made since November, when the new air plant of Canadian Mining and Finance Co. was put into operation.

In spite of the inadequate supply of air, satisfactory progress was made in underground developments. The 800 ft. level has been reached and the No. 1 vein has been found to persist to that level. The main shaft has been carried down to 550 ft. and will be continued to 800 ft. during the present year. The levels below 800 ft. will be opened up from the new central shaft of Canadian Mining & Finance Co., Ltd., although it is possible that a winze may be sunk below 800 ft. before the Central shaft workings reach the Hollinger ore bodies.

We now have between 65,000 and 70,000 tons of ore broken and ready for milling, in case any emergency should interfere with the regular operations in the mine. The gold contents of this ore amount to approximately $750,000. With the increased supply of compressed air which is now available for operating drills, it is intended to build up this reserve to a point which will insure continuous operation of the mill through any contingency which may arise.

No. 1 vein shows a falling off of $601,690 due to a lowering in grade from $19.56 to $14.85 per ton. No. 16 vein is a recently developed lens which is parallel to the southern portion of No. 1 vein. No. 10 vein has been reached by cross-cut upon the 200 ft. level, and has been removed from the collection of miscellaneous veins. Veins 9, 11, 12, 13, 14, 23, 33, 35, 36, 39, 42 and 43, which constitute the "Miscellaneous Veins" have been reviewed in previous reports, and do not require further mention as no new work has been done upon them.

The potentialities of the property are not indicated in the estimate of ore reserves. There are over forty known veins, which have thus far not been carefully investigated. Diamond drill holes have indicated a number of ore bodies carrying payable values, which have yet to be reached by underground workings. After four years of work upon the 100 ft. level we are still finding upon that level occasional and unexpected bodies of ore. Exploration work upon the 200 ft. level has also yielded gratifying results, and although we have been working steadily for three years upon this level, we are consistently finding new ore, and our neighbors (Acme Gold Mines) are within forty feet of our boundary driving upon one of their best veins at a point where we have done no work. Each year develops a fuller knowledge of the characteristics of the ore bodies with which we are working, enabling development work to be carried on with a greater degree of certainty. There have been no disappointments of any kind in the mine during the past year, and it is expected that the present year will show continued improvement in the property.

Summary of Ore Reserves, Hollinger Mine.

	Tons	Value Per Ton	Estimated Gross Value Dec. 31, 1914	Estimated at Dec. 31, 1913
No. 1 Vein	333,850	$14.85	$ 4,958,210	$ 5,559,900
No. 2 Vein (North)	165,720	10.71	1,775,740	2,129,500
No. 2 Vein (South)	111,150	7.96	885,690	....
No. 3 Vein	22,600	7.47	169,000	169,000
No. 4 Vein	163,330	11.37	1,857,670	1,398,800
No. 5 Vein	50,900	12.53	637,760	406,500
No. 7 Vein	17,000	10.51	178,000	265,000
No. 8 Vein	45,910	8.52	390,740	326,000
No. 10 Vein	9,000	12.00	108,000	....
No. 16 Vein	56,200	8.65	486,130	....
No. 37 Vein	32,800	12.22	400,900	400,900
No. 38 Vein	5,800	16.17	93,800	124,000
No. 41 Vein	90,700	8.34	756,780	33,200
No. 44 Vein	8,000	20.00	160,000	192,000
Miscellaneous	50,000	10.00	500,000	600,000
	1,162,960	$11.49	$13,358,420	$11,271,400

The above estimate of reserves shows an increase of 317,660 tons of ore, and an increase from $11,604,800 to $13,358,420 in gold contents, as compared with the estimates made at the end of 1913. During the year we have milled 208,936 tons containing $2,857,397.54, which figures, taken with the increase in estimated reserves, show 526,596 tons, containing $4,611,017.54, to have been developed during the year. The average value of the ore now shown is $11.49 per ton, as compared with $13.71 per ton at the end of 1913, this falling off in grade being primarily due to the development of considerable tonnages of lower grade ores, thus lowering the over-all average value.

Large increases are shown in several of the veins by the development carried out during the year, the principal increases being:—

No. 2 Vein	$531,930	increase
No. 4 Vein	458,870	increase
No. 5 Vein	231,260	increase
No. 16 Vein	486,130	increase
No. 41 Vein	723,580	increase

Speculative.

In order to forestall possible criticism, let it be noted that the purpose of this report is to place in the hands of shareholders all available information concerning the condition of their property.

In addition to the extent of the ore bodies which may be measured with approximate accuracy, the shareholder is chiefly concerned with the possibilities of future developments.

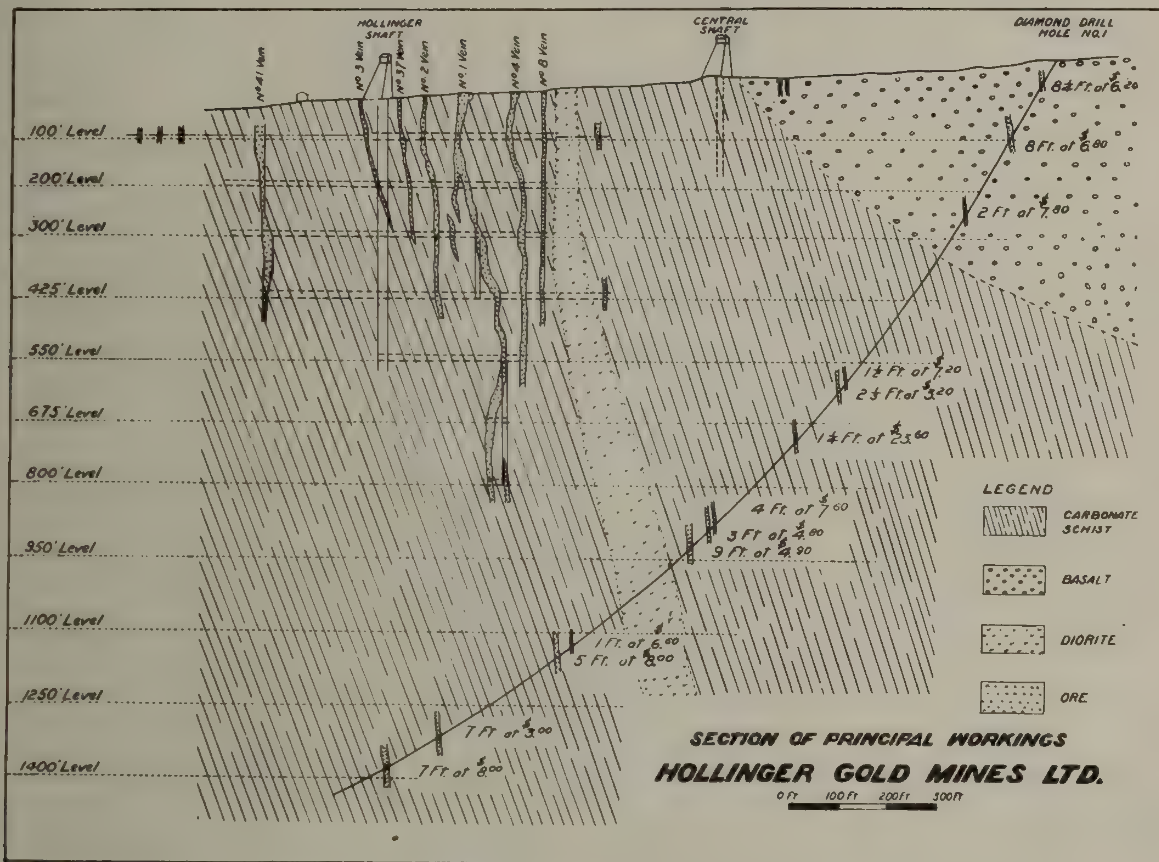
Fifty-four veins have been located upon the property, and thus far only twelve of these have been reached by underground workings.

Aside from this interesting multiplicity of veins, the all important feature is that of depth, and in order to

obtain some information upon this point we have done a certain amount of comparatively deep drilling. The accompanying "Section of Principal Workings" shows the results obtained by means of diamond drill hole No. 1. This hole was driven to an inclined depth of 2,000 ft. and when drilling was stopped had reached a vertical depth of 1,425 ft. below the surface.

mineralized ground is usually somewhat friable, and consequently there is some loss of core when drilling through quartz and mixtures of quartz and schist.

The information furnished by the drill hole is twofold; first, there is no change in rock formation to a depth of 1,425 ft.; second, there is no change in vein characteristics to a depth of 1,425 ft. The gold values



Section of principal workings, Hollinger Mine, Porcupine

In the course of drilling, thirteen mineralized zones were passed through, the results of sampling being as given below:

Inclined Depth of Hole Feet	Vertical Distance Below Surface Feet	Width of Ore Body Feet	Average Value Per Ton
20	17	8.25	$ 6.20
180	140	8.00	6.80
350	275	2.00	7.80
770	600	1.50	7.20
790	610	2.30	3.20
925	710	1.20	23.60
1,160	875	3.80	7.60
1,175	890	3.00	4.80
1,225	925	9.20	4.90
1,560	1,120	.80	6.60
1,575	1,140	5.00	8.00
1,870	1,354	6.60	3.40
2,000	1,424	7.00	8.00

Note.—Vertical depths in bore hole refer to depths below the collar of the bore hole.

The values given are the averages in each case. The sampling of each piece of core gave the same erratic results as are obtained in the course of the regular work of sampling in the mine, the ore at depth varying greatly in value within a few inches.

In considering the widths of the various ore bodies passed through, it must be noted that the results given are calculated from the lengths of core obtained. The

obtained by drilling are about those which might be reasonably expected if a drill hole were to be driven through the vein system at any random point below the 200 ft. level.

A second drill hole was started, to cross the ore bodies from the direction opposite to that of the first hole, but unfortunately this second hole flattened its course and at a depth of 900 ft. had assumed a position practically horizontal. As our mine workings were at the time approaching a depth of 800 ft., it was felt that the limited information to be gleaned from the second hole did not warrant the heavy expense of further drilling and the hole was consequently abandoned without having reached the vein system.

As a result of the diamond drilling, we may with considerable assurance anticipate the continuance of operations to a depth of at least 1,500 ft., with strong possibilities at greater depths, as nothing has yet occurred to indicate a limitation of the depth to which payable values will persist.

It is reasonable to assume that some of the ore bodies encountered in drilling are continuations of the veins being worked upon the upper levels, and such being the case, it is not unreasonable speculation to anticipate from the ore bodies now being worked, a production of something over twice the value of the ore shown in the "Estimate of Ore Reserves." Beyond this are the possibilities of production from the veins not yet de-

veloped, and also the value of ore which may be encountered at levels below the depth of the bore hole.

The Mill.

The work in the mill has produced satisfactory results, and after considerable experimenting, we have during the latter part of the year, developed our practice along lines which have enabled an increased tonnage to be treated while at the same time the extraction has been greatly improved.

The detailed costs are based upon the total tonnage treated.

Based upon the tonnage of Hollinger ore milled, 208,936 tons, the total cost per ton was $1.220.

During the year there has been stacked for retreatment 6,062 tons of concentrates of an average value of $8.85 per ton. The total value $53,686.00 is an asset not shown upon our books and hence whatever portion is eventually recovered by retreatment will result in an increased profit.

The costs of operation contain a direct expenditure of $7,292.08, amounting to $0.034 per ton for alterations to plant. Besides this there have been considerable expenditures upon alterations which have been directly absorbed by the costs charged to the different operations. Hence the actual working costs of milling have been in reality somewhat less than the costs shown. It is anticipated that a considerable reduction in milling costs will result during the present year, due to improved methods and to the larger tonnage which will be treated.

Three years ago the mill was designed for a crushing capacity of 300 tons per day, having 30 stamps installed, and cyanide equipment sufficient to treat 500 tons per day. In the second year of operation, ten additional stamps were provided, thus bringing the crushing capacity up to 500 tons per day. During the past year the number of stamps has been increased to sixty, and alterations have been made to the cyanide plant, with the net result that the capacity of the mill has been increased to 800 tons per day. The rapid development of the mine has continually demanded increased milling facilities, and the decision to treat ore from the Acme and Millerton properties now makes it necessary to add considerably to the milling plant. We are in the midst of alterations and additions, which when completed, will bring the capacity of the mill up to 1,600 tons per day. The expenditures for this greatly increased plant have all been met from profits, without interfering with the payment of regular dividends. It is expected that by the middle of February eighty stamps will be dropping, to be followed by twenty more about the middle of March.

Later in the year it is intended to install a screening plant and tube mills, for treating that considerable portion of the ore which comes from the mine in a condition fine enough for immediate grinding, without the necessity of stamping.

Present milling practice adheres closely to the lines laid down in the original mill, except that we are now about to resort to continuous decantation for the gritty, quick settling portion of the ore, while the more flocculent portions will continue to be treated in our filter plant. The treatment of concentrates has not yet been perfected and these are still being stored after making a partial recovery of their contained

Distribution of Milling Costs, Hollinger Gold Mines, Ltd.

Account	Labor	Stores.	Total	Per ton of Ore Milled
General milling charges	$ 5,226.62	$ 6,171.04	$ 11,397.66	$0.054
Superintendence	9,856.07	....	9,856.07	.047
Tailings disposal	2,785.04	948.05	3,733.09	.018
Lighting	431.33	1,953.32	2,384.65	.011
Heating	1,023.41	7,282.32	8,305.73	.039
Shoveling in bins	2,463.14	....	2,463.14	.012
Crushing	8,180.11	8,646.70	16,826.81	.079
Conveying	3,712.61	3,527.33	7,239.94	.034
Stamping	12,136.72	21,679.91	33,816.63	.160
Classification and tube milling	7,739.31	32,203.07	39,942.38	.188
Concentration	8,174.17	4,969.30	13,143.47	.062
Handling concentrates	491.01	1,084.04	1,575.05	.007
Treating concentrates	4,340.59	2,478.55	6,819.14	.032
Handling pulp	2,403.95	6,163.52	8,567.47	.040
Thickening	1,961.80	990.01	2,951.81	.014
Continuous decantation	4,834.00	1,644.22	6,478.22	.031
Filtration	11,581.36	10,233.75	21,815.11	.103
Neutralizing	751.95	1,848.05	2,600.00	.012
Clarifying and precipitation	1,732.30	11,626.16	13,358.46	.063
Refining	6,197.76	6,267.33	12,465.09	.059
Pumping solutions	1,948.29	2,410.07	4,358.36	.021
Cyanide	14.77	17,523.02	17,537.79	.083
Cleaning mill	3,913.58	133.17	4,046.75	.019
Alterations	2,826.52	4,465.56	7,292.08	.034
Assaying	2,086.87	1,132.20	3,219.07	.015
	$106,813.28	$155,380.69	$262,193.97	$1.237
Less treatment charges on Acme Gold Mines, Limited, ore—2,910 tons	2,906.70	4,228.40	7,135.10	.017
	$103,906.58	$151,152.29	$255,058.87	$1.220

values. Experience in the mill indicates strongly that the best results will be obtained by separating the ore into its component parts and providing a special treatment for each.

It is anticipated that the final practice in the mill will be: Amalgamation for nuggets. Settling or filtration for slimes. Continuous decantation for sands. Regrinding and increased agitation for concentrates.

Milling Record.

	Hollinger	Acme	Total
Tons of ore milled.	208,936	2,910	211,846
Average value per ton . . .	$13,676	$11.176	. . . .
T'l values sent to mill	$2,857,397.54	$32,521.93	$2,889,919.47
Average tons per day			583.59
Per cent. of possible time run			92.2%
Aver. tons per 24 hours of running time			632.97
Stamp duty tons per 24 hours of running time.			13.30
Unrecovered Values—			
Concentrates stored for re-treatment			$53,686.00
Lost in filter tails			$116,879.00
Total.			$170,565.00
Values recovered			$2,719,354.47
Value per ton in tailings			$0 56
Cyanide consumed per ton of ore			0.525 lbs.
Lime consumed per ton of ore			1.557 lbs.
Zinc consumed per ton of ore			0.532 lbs.
Acid consumed per ton of ore			0.216 lbs.
Lead acetate consumed per ton of ore . .			0.0031 lbs.
Tons of solution precipitated per ton of ore.			2.315
Zinc added per ton of solution			0.230
Average value of pregnant solution . . .			$5.698

General.

The development of the Hollinger has led to greatly increased operations, and the persistent demands for additional facilities have been met from time to time by alterations and additions, and by working all available plant at an overload.

During the past year the opening up of the Acme mines has added another factor to the demand for more equipment, and it has become necessary to make a broad survey of the requirements of all companies controlled by Canadian Mining & Finance Co., Ltd.

The Hollinger system of veins extends to the south-west into the property of Millerton Gold Mines, Ltd., and to the north-east into the property of Acme Gold Mines, Ltd. For the purpose of securing maximum economy in operation, and a minimum of capital expenditure for equipments, it is desirable that the operations of the three properties should be centralized and carried on as one large undertaking, rather than as three separate, smaller undertakings.

The apparently logical course would be to incorporate the three properties into one. Such a course, however, is not feasible, owing chiefly to the large amount of development work which has been done upon the Hollinger claims, and the comparatively small amount of development which has been done upon the other properties. Under existing conditions it is not possible to arrive at valuations which would be satisfactory to all parties concerned.

It is therefore expedient to adopt another course in order to secure the desired economies, and we have worked out plans, whereby most of the advantages which would follow an amalgamation, will be secured. In the matter of capital expenditures it is proposed to make an equitable adjustment between the various interests.

The Canadian Mining & Finance Co., Ltd. (proprietor of the Acme and Millerton companies), has already constructed a central air compressing and water pumping plant, which will be sufficient for the combined requirements of the several companies for some years to come. They are also sinking a central shaft which will serve all three of the companies, and which will be equipped with a central coarse crushing plant.

The Hollinger Company is increasing its mill to accommodate Acme ore and will make further additions when the necessity arrives for treating Millerton ore.

By means of centralizing operations as indicated, considerable economies will ensue. Instead of having three separate deep shafts, each equipped with expensive hoisting apparatus, crushers, gathering locomotives, etc., and requiring the services of three sets of operators, we will have one central shaft which can be worked continuously at full capacity, and hence at minimum cost to each company, and the amount of ore to be handled will justify the installation of expensive and highly economical plant.

The Central Shaft.

This shaft will have six compartments with stations at 425 ft., 800 ft., 1,250 ft., and, it is hoped, much deeper levels. From each station, crosscuts will be driven to tap the various ore bodies on the different properties. Electric locomotives operating in the crosscuts, will collect the ore from each property and deliver it at the central shaft. The ore will pass through preliminary crushers, and will then be hoisted to the surface and delivered to secondary crushers, which will reduce it to a size suitable for stamping in the Hollinger mill. Two shaft compartments will be utilized for hoisting ore, two for handling men and supplies, one for carrying on development at levels below the working level, and one for ladder-way, pipes and electric conductors. While the levels at the central shaft will be at intervals of 450 ft., it is proposed to develop the various ore bodies by means of sub-levels spaced at shorter intervals.

The original Hollinger hoisting equipment has become entirely inadequate for the increased tonnage and greater depths, making the provision of increased facilities imperative, and in a lesser degree the coarse crushing plant is also in the same need of expansion. The Acme Company is faced by the same problem, its temporary plant being too small to meet the demands. Temporary expedients will be used at the Hollinger and Acme to tide over the time required for sinking and equipping the central shaft, and it is expected by the middle of 1916, that the latter will be in operation.

The Hollinger mill, when the present additions and alterations are completed, will have a capacity of from 1,500 to 1,600 tons per twenty-four hours, and space is available for bringing this capacity up to 2,000 tons per day should such a step become necessary to meet the increasing requirements of the Hollinger or other properties. The present Hollinger needs for milling capacity are about 1,000 tons per day, while the Acme will require 500 tons per day to be treated, within a few months. Centralizing all mill operations will result in reduced costs of treatment per ton of ore, a decided benefit to each company concerned.

In order that there may be no disagreement as to the ownership of the bullion produced, provision is being made to keep each company's ore separate through the

entire process of milling and refining. This requires a duplication of certain apparatus which otherwise would not be necessary; but it is felt that by so doing the most satisfactory results will be obtained.

Central Air Compressing Plant.

The demand for compressed air having entirely outgrown the capacity of the old compressing plants, and the knowledge that future requirements will exceed the present demands, has led to the construction (by Canadian Mining & Finance Co., Ltd.) of a modern plant containing the highest type of machinery. The building is of reinforced concrete and steel, being absolutely fireproof. Three compressors, having a capacity of 4,500 cubic feet of free air per minute each, have been installed with space for additional units. One compressor, a Fraser & Chalmers machine, is of special design, being constructed with valves which automatically adjust the output of the machine to the exact requirements of the demand for air, thus doing away with peak loads and thereby reducing the cost of power, which is purchased upon a basis of peak loads. The other two compressors, supplied by Nordberg, are also of special design, for not only are they a particularly efficient type of machine, but they possess the unique advantage of being reversible; that is, they may be operated as steam engines and their motors may be used for generating electric power. This provision was made with a view to providing a standby or emergency plant, which can supply a certain amount of power in case of failure in the usual supply of electricity developed by water power plants.

A boiler plant sufficient to meet these emergency requirements has also been installed, and while it is hoped that this may never be required, there is satisfaction in the knowledge that an interruption to our normal supply of power will not result in a complete cessation of operations. Incorporated with the air compressing plant is a pumping plant, for supplying water to the Hollinger mill and to emergency fire pumps.

While the Canadian Mining & Finance Co., Ltd., has met the entire expenditure for this plant, it is possible that the Hollinger Company may be asked to bear a portion of the cost, in view of the heavy outlay which the former company is contemplating in connection with the central shaft. This is a matter which will be adjusted when the relative investments for mill, air plant and central shaft are finally determined.

Costs of Operation.

In the last annual report a forecast was made that the costs of operation would be reduced to approximately $4.50 per ton. The average working cost per ton during 1914 amounted to $4.43 (exclusive of amounts written off for description). It is therefore evident that the expected reduction in costs was fully realized. Further reductions will follow, and it is hoped that by the end of the present year our working costs will be found not to exceed $4.00 per ton. It is highly probable that ultimately the costs will be reduced to approximately $3.50 per ton, but this result cannot be reached until the new central shaft is in operation and a very large tonnage of ore is being milled.

Labor conditions during the year have been good, and while there has been a gradual reduction in working costs, there has also been a gradual increase in the amounts paid to employees. A system has been adopted of granting a bonus to men, in proportion to the length of time that they have been in the company's service. After one year's service a man receives a bonus of 15 cents per day; after two years, 30 cents per day; after 3 years 45 cents per day. These amounts are not added to wages, but are paid by separate cheques and every man who works for day wages receives the same bonus, regardless of the position held by him. By this means there has been disbursed among employees, during the past year, the sum of $8,935.25.

The average number of men employed during the year has been 546, starting with 510 at the commencement of the year, and ending with 725. The men were engaged upon the following classes of work:

Mining	297
Construction	109
Mill, office, general	140
	546

The present year will not see any great reduction in the total number of employees. In the present year more men will be employed in the mine, while there will be a great reduction in the number of employed upon construction and general work. In the past there has been a large amount of work done in road building, surface clearing, etc., all of which has been charged to operations, but this will be very much less in the future, thereby reducing the number of men required for general work.

BRAVE MINERS REWARDED.

The London Times, January 14th, reports three awards for conspicuous bravery in mines. The "Edward Medal," or "Miners' V. C.," was won by Joseph Cook, David Easton and James Kennedy.

On the morning of the 31st of January, 1914, Joseph Cook was underground in the Blackhouse colliery, Durham, near the bottom of an old shaft, filled with rubbish. Water had accumulated in it, and the weight of the debris burst out the pack walls at the shaft bottom. Seeing the danger, Cook rushed in bye at the risk of his life to warn two shifters who were working there and had no way to egress except past the bottom of this shaft. Before the three could get out, the debris filled up the road from floor to roof for a distance of 35 yards, completely cutting off their escape. The three men were eventually released after 22 hours' confinement.

On the 11th of January, 1913, two native "boys" employed in the Hatting Spruit colliery, Natal, went without orders into a part of the mine which was filled with poisonous fumes from a gob fire, and before they could return, fell unconscious. David Easton was one of a party who at great risk to themselves entered the danger area, from which they eventually succeeded in rescuing the boys. The other men of the same party were awarded medals, with which they have already been decorated.

On the 2nd of June, 1914, about 1.50 p.m., a miner was engaged at the Earnoch colliery, Lanark, in taking down head coal when the coal fell, pinning down his foot. James Kennedy bravely went to his assistance and continued to make every effort to release him, notwithstanding two further falls, which occurred at short intervals, completely smothering him. With the help of others who had arrived, Kennedy managed after three hours' work to release the imprisoned man, who was unfortunately found to be dead.

THE TESTING AND APPLICATION OF HAMMER DRILLS*

By Benjamin F. Tillson.

The hammer drill rightly receives the credit for having made the one-man drill possible, and so many economies seem possible through the proper application of different types of hammer drills to various mining, quarrying, and excavating operations, that an indication of the economies effected by the New Jersey Zinc Co. at its Franklin mines may be of pertinent interest. When this company commenced its trials of hammer drills in 1907, these tools had not been developed to one-fourth the capacity and refinement which they have at present. At that time it was frequently stated that such a small tool, drilling holes of less diameter than the reciprocating rock drill, could not drill enough holes in a shift to permit the placing of sufficient explosive to break a tonnage of ore comparable with that produced by the "rock drills;" that the placing of small holes inclined upward, at angles steeper than 40 degrees above the horizontal, could not be expected to produce results equal to the large flat, wet or dry, holes in the breasted back of an overhand stope, and would only shatter the ground so as to make the back unsafe. In spite of these adverse opinions, the hammer drills first showed their superiority over both heavy and light reciprocating drills in raising and in stoping, and then in drifting and quarry work. As a result, all of the reciprocating drills at the Franklin mines were scrapped three years ago, all of the mining work being accomplished with increased efficiency, as shown in detail in this article.

With the advent of the hammer drill in this property, it was considered advisable to make comparative tests of all the tools accessible, and it has since been the policy to investigate the merits of any advance of the drilling art in order to get the maximum amount of work from the tools. The necessity of devising some means of standardizing drill tests, and of measuring the consumption of compressed air as well as the drilling speed, was early realized.

The common test was to fill a measured air receiver with compressed air at a certain gauge pressure, run the drill until the pressure had dropped to too low a figure, then compute from the time, drop in pressure, and capacity of the receiver, the cubic feet of free air used. This was not considered a fair indication of the drilling capacity of a machine, since the performance of some drills did not vary directly with the absolute pressures of the compressed air.

Air Meter.—It was, therefore, found expedient to build a water displacement air meter with which the drill test could be carried on for any length of time without serious variations in the desired air pressure. This apparatus, as shown in Fig. 1, consists of two tanks, half filled with water, and made of 12 in. pipe with blank flanges, gauge glasses being mounted on one, a four-way cock connecting the compressed air supply pipe with both tanks and the air line going to the drill. This device gives more accurate results than the common types of water or gas meters; and since any errors are due to the human element of reading the gauge glasses and reversing the four-way cock, they tend to be compensating throughout a number of tests.

The procedure is as follows: Air is drawn by the drill from the receiver C, which tends to trap any moisture carried over the air from tanks A and B and assures a constant pressure while the four-way cock is reversed. In the arrangement shown in Fig. 1, the receiver draws its supply of air from the tank B and the water rises in this tank by virtue of the pressure of air admitted from the air main through the four-way cock to the top of tank A, where the water is being forced downward and through the 2 in. connecting pipe to tank B. When the water has risen to a certain point

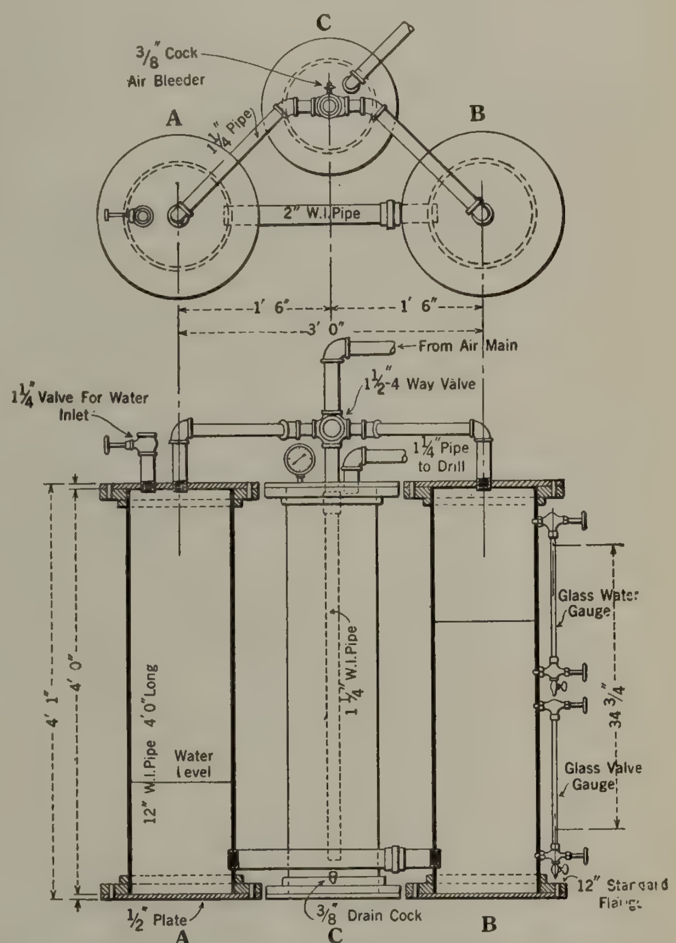


FIG. 1.—WATER DISPLACEMENT AIR METER FOR ROCK-DRILL TESTING.

near the top of the gauge glass in tank B, the four-way cock is reversed and the inlet air is supplied to the top of tank B; the drilling air is then taken from the top of A, the reversal of the cock again being made when the water in tank B has fallen to a point near the bottom of the gauge glass.

A pet cock is placed on the top of tank C so as to permit the bleeding of air to bring the water columns to the desired point for starting a run, and another pet cock is attached to the bottom of the same tank in order to permit the drainage of water. For convenience in measuring and computing, a run is made on the supply of compressed air indicated by a certain number of reciprocations of the water columns between fixed points on the gauge glasses; the pressures are measured on the air gauge mounted on tank C, the length of time is taken by a stop watch, and the consumption of free air per minute is computed. Unless a pressure regulator is installed between the four-way cock and

*Extracts from a paper published in the Bulletin of the American Institute of Mining Engineers, February, 1915.

the receiver C, or else a globe valve at this point is operated manually to throttle the air so as to maintain a constant pressure, it is evident that the air pressure at the drill will vary in accordance with the water column supported by the inlet air pressure, but since the gauge glass marks are in this instance set 34¾ in. apart, the maximum variation in pressures is about 1¼ lb. per square inch; it is difficult to find a pressure regulator which will control a pressure of 90 or 100 lb. per square inch to a closer degree of accuracy, and the sensitiveness of drills to air pressures and the accuracy of time and distance measurements rarely exceed this error.

It is obvious that in comparative drill tests the following factors must be considered: The nature of the rock drilled; the gauge of the drill bits and their form and condition; the maintenance of equal compressed air pressures; similar inclination and approximate depths of drill holes; equal vigor in the rotation of hand-rotated tools; and proper fit of the drill shanks in the chuck bushings, as well as their construction so that the blows are delivered on a plane surface of proper size at right angles to the axis of the drill steel and at the centre of its shank end. In the tests summarized in Table I, 1¾ in. has been taken as the standard diametral gauge of the bit, since it is a dimension which averages the gauges of drill steels used in reciprocating rock drills and is fair in determining the performances

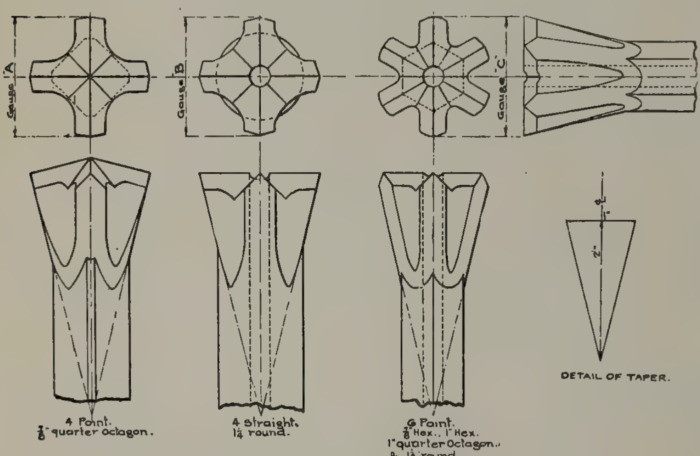


Fig 2.—Types of Drill Bits used at Franklin Mines of the New Jersey Zinc Co

of such tools; it also represents almost the largest gauge necessary in hammer-drill stopers or block-holers, so that equal or even better performances may be expected from them as a hole is deepened with the smaller gauges in a set of drill steel.

At Franklin, the testing rock is a compact coarsely crystalline white limestone, which greatly resembles a marble, and this rock proves a fair average of the various qualities of ore met in the mining operations. Although it is not hard, for a well tempered drill bit can drill 3 or 4 ft. of hole before its cutting edges are materially dulled, and although it seems to chip freely, yet is possesses a compactness and toughness which is likely to prove surprising to one who has not previously tested a drill in it. Tests with various machines in Franklin, and elsewhere, indicate that this white limestone does not cut quite so fast as a sharp drill can achieve in Cripple Creek granite; is about on a par with Barre granite; and cuts slightly faster than Quincy granite. The chief difference is that a good drill will cut this limestone as fast in the second or third minute of its run, while it would have been dulled by the first minute's run in the granites, causing its cutting speed to fall off materially in the second and third minutes. Raised-centre cross bits are the standard type used with solid steel in these tests, and flat-faced six point bits are generally used with the hollow steels, in general the cutting speed of these bits being about the same if the rotation of the drill steel is free. Fig. 2 shows the forms of the drill bits used at the Franklin mines.

The results of Table I. indicate the improvements in hammer drills, from the operators' standpoint of efficiency, during four years of advancement in the art; and it may be interesting to note that, so far as we know, no drills of the present day surpass in drilling speed and low air consumption the best drills listed in this table, although several makes of hammer drills are on a par with them. In order to avoid invidious comparisons between the different makes of drills, symbols have been used to designate each certain make and design of drill. The following abbreviations have been used in this table:

Auto aux V = automatic auxiliary valveless control of rotations.

Auto rifle = automatic rotation caused by a piston reciprocating as though it were controlled by a rifle bar.

Dir. air = direct-air feed, or one in which the feed cylinder is rigidly attached to the hammer cylinder and in which the feed piston or plunger extends from the rear end of the machine by virtue of the air pressure applied to it.

Rev. air = reversed-air feed, or one in which the feed piston is rigidly attached to the hammer cylinder and the feed cylinder is free to extend backward, so readily adapts itself to the customary column mounting of stoping drills.

Some tests were included in this table for the consideration of points to be made later. Before studying the improvements in hammer drill efficiency it seems wise to explain the reasons for offering the figures in the last column of figures as representing a factor of "drill desirability."

Cost.—In determining the relative merits of rock drills, whether of the riciprocating or hammer type, the logical basis is one of cost. Therefore, the drill which bores a foot of drill hole of standard cross-section at the lowest cost rate for drilling labor, power and maintenance (including amortization), would have the highest "factor of desirability"; and a formula to express this may be developed as follows:

Let

F be the "factor of desirability,"

D be the cost of drilling labor per foot of hole,

P be the cost of power per foot of hole,

M be the cost of maintenance per foot of hole.

Then,

$$F = \frac{1}{D + P + M}$$

Let

t = Period of time for drilling speed test, in minutes.

d = Depth of hole drilled in time, t, in inches.

$S = \frac{d}{t}$ = Drilling speed during actual running of machine, in inches per minute.

L = Hourly wage of drilling labor, in cents.

O = Percentage of time spent in drilling to total operating time, including the changing of drill steels and shifting to new positions and starting of new holes.

Then

$$D=\frac{L}{\frac{60SO}{12}}=\frac{L}{\frac{5dO}{t}}=0.2\,\frac{tL}{dO}$$

Let

p = Power cost to produce 100 cu. ft, of free air, compressed to standard drill-testing pressure, in cents.

v = Number of cubic feet of free air used in test by operating drill.

d = Depth of standard hole drilled, in inches.

Then

$$P=\frac{12pv}{100d}\,0.12=\frac{pv}{d}$$

equation we obtain.

Substituting these values of D and P in the original

$$F=\frac{1}{0.20\frac{tL}{dO}+0.12\frac{pv}{d}+M}=\frac{d}{\frac{0.2L}{O}t+0.12\,pv+dM}$$

Since L is a constant for any particular mine, and O for a given number of steel changes with any particular type of drill—such as a column mounted reciprocating drill, a column mounted hammer drill, an air-feed hammer drill, and block holing drill, etc.—we may simplify the equation by substituting

$$k=\text{coefficient of drilling}=\frac{0.20L}{O}$$

Also, since p is a constant for any particular mine we may further simplify by placing

$$k'=\text{coefficient of power}=0.12\,p$$

and we then have the general equation for any particular mining conditions and type of drill

$$F=\frac{d}{kt+k'v+dM}$$

However, the correct value for maintenance and amortization of any particular type and make of drill can be determined only after operations extending over months or years, so that this factor may well be left out of a formula which is to be used for classifying drills after drilling speed and power consumption tests, which may be completed in a short time. The consideration of the reduction of drilling speed and the increase of power consumption, which occur in a drill because of wear or any other normal results of service, may fairly be placed in the same class as maintenance. Judgment as to the materials, workmanship and design of any drill, as well as reports of its satisfactory service elsewhere, will lead to a rough estimate of the final desirability of a drill if it has shown a high standard, on testing based on drilling speed and power consumption.

The equation is thus simplified to the form

$$F=\frac{d}{kt+k'v}$$

Other factors.—But other highly important factors enter into the problem of selection of a drill, namely, the reduction in labor units, capital and overhead charges brought about by an increased drilling speed and increased tonnage per machine; the increased efficiency of supervision and work caused by the reduction and concentration of the number of working places; the possibility of producing a greater tonnage from any property with a limited number of working places; and the possibility of reducing the drilling equipment, with its attendant stock of spares, hoses and connections, and extensive air mains, if a drill with a greater drilling speed may be employed.

Factor of desirability.—It therefore seems that the following formula is more indicative of the actual merits of drills, although theoretically it has no derivation, and must be considered empirical; it also possesses the virtue of reducing to a simple form. This formula for a "factor of desirability" has been used for the past six years at the Franklin Furnace mines of the New Jersey Zinc Co. All coefficients have been omitted since the following drill tests have all been under the same standard conditions.

$$F'=\frac{1}{DPM}$$

TABLE I.—*Summary of Tests of Representative Drill Types Made by the New Jersey Zinc Co.*

Symbol for Drill	Date	Type of Drill: Rotation	Control of Piston	Style of Feed	Weight	Air Press. Lbs. per Sq. In. (Gauge)	Shape of Drill Bit	Free Air, Cu. Ft. per Min.	Drilling Speed, Inches per Min.	Free Air, per Inch Drilled	Factor, In. per Min. Divided by Free Air per Inch	Condition of Bit and Remarks. General:—Air measured by displacement of water. Rock was white-crystalline limestone. Gauge of bits was 1 1/16 to 1 3/4 in.
A	7/17/09	Hand.	Valve.	Dir. air.	75	93	Raised crux.	60.4	3.85	15.62	0.246	1 corner broken, with extension.
A_1	7/27/09	Hand.	Valve.	Dir. air.	84	92	Raised crux.	73.2	3.83	19.15	0.200	With extension.
B	7/27/09	Hand.	Valve.	Dir. air.	76	90	Raised crux.	90.0	3.20	[illegible]	0.118	
1B	7/27/09	Hand.	Valve.	Dir. air.	76	72	Raised crux.	76.8	4.28	17.90	[illegible]	Different drill of above model.
C	7/27/09	Hand.	Valve.	Dir. air.	64	90	Raised crux.	[illegible]	5.10	12.37	0.414	
D	7/27/09	Hand.	Valve	Dir. air.	74	90	Raised crux.	92.7	4.50	[illegible]	0.218	
D	7/27/09	Hand.	Valve.	Dir. air.	74	85	Raised crux.	[illegible]	5.52	15.6	[illegible]	Bit broken.
E	7/27/09	Hand.	Valveless.	Dir. air.	84	87	Raised crux.	42.0	1.93	21.7	0.089	
F	7/27/09	Hand.	Valveless.	Rev. air.	[illegible]	95	Raised crux.	[illegible]	3.38	20.3	0.167	
G	10/1/09	Hand.	Valve.	Dir. air.	78	[illegible]	Raised crux.	75.8	5.65	13.4	0.421	
G_1	10/8/09	Hand.	Valve.	Dir. air.	73	92	Raised crux.	79.5	5.91	13.4	0.450	
G_2	10/25/09	Hand.	Valve.	Dir. air.	73	88	Raised crux.	79.5	6.00	13.2	0.455	
G_3	12/6/09	Hand.	Valve.	Dir. air.	78	96	Raised crux.	83.5	7.00	11.9	[illegible]	
H	10/20/09	Hand.	Valveless.	Rev. air.	56	95	Flat hex.	29.8	2.46	12.1	[illegible]	No tappet.
1H	10/21/10	Hand.	Valve	Rev. air.	..	93	Crux.	66.7	2.10	31.8	0.066	
J	12/12/10	Hand.	Valve.	Rev. air.	..	94	Crux.	[illegible]	7.30	9.15	[illegible]	High run.
J	12/15/10	Hand.	Valve.	Rev air.	..	94	Crux.	66.3	6.70	[illegible]	0.675	Average 8 runs.
J	2/25/11	Hand.	Valve.	Rev. air.	..	94	Crux.	[illegible]	6.25	11.01	0.567	Average 23 runs.
K	3/2/11	Hand.	Valve.	Rev. air.	..	92	Crux.	77.6	7.29	10.65	[illegible]	
K	3/7/11	Hand.	Valve.	Rev. air.	..	94	Crux.	75.4	6.90	10.90	0.633	Average 10 runs.
L	4/10/11	Hand.	Valve.	Rev. air.	..	97	Crux.	58.0	[illegible]	9.21	[illegible]	
L	4/10/11	Hand.	Valve.	Rev. air.	..	97	Crux.	58.5	6.19	9.45	0.655	Average 7 runs.
L	4/18/11	Hand.	Valve.	Rev. air.	..	[illegible]	Crux.	55.8	6.55	8.52	0.769	Average 7 runs.
M	4/21/11	Hand.	Valveless.	Rev air.	..	95	Raised crux.	54.7	9.35	5.85	1.600	High run to 1 1/16-in. bit.
M_1	6/24/11	Hand.	Valveless.	Dir. air.	..	99	Raised crux.	58.5	11.54	5.07	[illegible]	Bit a little soft.
1M	6/24/11	Hand.	Valveless.	Dir. air.	..	99	Raised crux.	58.5	9.09	6.45	1.410	Average 3 other runs, same machine.
M_2	8/30/11	Hand.	Valveless.	Dir. air.	..	100	Raised crux.	65.0	10.75	6.04	1.780	
M_2	8/30/11	Hand.	Valveless.	Dir. air.	..	99	Raised crux.	62.9	9.56	6.59	1.450	Average 11 runs.
N	9/27/11	Hand.	Valve.	Dir. air.	..	99	Raised crux.	36.0	5.28	[illegible]	0.774	
N	9/27/11	Hand.	Valve.	Dir. air.	..	99	Raised crux.	39.2	4.63	[illegible]	0.540	Average 11 runs.
N_1	10/24/11	Hand.	Valve	Dir. air.	65	96	Raised crux.	66.4	2.67	24.8	0.108	Average 14 runs.
J	2/3/12	Hand.	Valve.	Dir. air.	..	97	Raised crux.	71.2	6.06	11.76	0.515	Drill "J" after 1 year's service.
× M_3	2/29/12	Hand.	Valveless	Dir. air.	..	99	Raised crux.	62.9	11.10	5.66	1.962	High run.
× M_3	2/29/12	Hand	Valveless	Dir. air.	..	.00	Raised crux.	63.5	10.48	6.06	1.739	Average 4 runs.
× O	3/5/12	Auto aux V.	Valveless	Dir. air.	..	98	Flat hex.	79.1	10.34	7.65	1.350	Hollow bit, no air through it, high run.
× O_1	6/3/12	Auto aux V.	Valveless	Dir. air.	[illegible]	100	Raised crux.	85.5	9.55	8.95	1.068	With pressure control on feed ½ fd., bit with soft center, No. 6.
× O_1	6/3/12	Auto aux V.	Valveless.	Dir. air.	87	100	Raised crux.	87.0	8.50	10 24	[illegible]	With pressure control on feed, fine bit. No. 12.
P	2/16/12	Hand.	Valve.	Dir. air.	..	100	Raised crux.	67.0	8.43	7.94	1.062	Hard to rotate.
P_1	5/13/13	Hand.	Valveless	Dir. air.	86	96	Raised crux.	55 8	10.76	5.18	2.080	Rotates freely.
P_1	5/13/13	Hand.	Valveless	Dir. air.	86	97	Raised crux.	59.5	11.03	5.40	2.043	Rotates freely
P_1	5/13/13	Hand.	Valveless.	Dir. cir.	86	96	Raised crux.	56 8	9.32	6 10	1.529	Average 9 runs.
P_1	5/13/13	Hand.	Valveless.	Dir. cir.	86	96	Flat crux.	57.1	7.98	7.17	1.110	Average 3 runs.
Q	5/16/13	Auto rifle.	Valve.	Rev. air.	.	91	Raised crux	51.4	6.12	8.39	0.730	
Q	5/16/13	Auto rifle	Valve.	Rev. air.	86	[illegible]	Db'le chisel.	48.2	8.18	5.90	1.388	Hollow steel.
R	9/25/13	Auto rifle.	Valve	Rev. air.	.	[illegible]	Raised crux.	112.0	6.85	16.25	0.421	Air bled to control feed press.
R	9/25/13	Auto rifle.	Valve.	Rev. air.	86	91	Flat hex.	102.2	7.50	13.63	0.550	Air bled to control feed press.

Since M is treated separately, as has been previously suggested, the equation becomes

$$F' = \frac{1}{DP}$$

Now if the same values previously deduced for D and P are substituted,

$$F' = \frac{1}{\frac{kt}{d} \times \frac{k'v}{d}} = K\frac{d^2}{tv}$$

where K is a new coefficient equal to the reciprocal of the product of k and k'.

Therefore, the "factor of desirability" equals the drilling speed, in inches per minute, divided by the power consumption, in cubic feet of free air, per inch drilled. It is quite evident that the factor gained from the quotient of inches drilled per minute divided by cubic feet of free air per minute (or the reciprocal of this quotient) gives merely the power consumption per inch of hole drilled and ignores the quantity of drilling which may be accomplished.

The application of both of these formulas for F and F' to a hypothetical problem may be of interest to show the comparative results within the limits of practice.

Let us assume that 30 h.p. is required to compress 100 cu. ft. of free air per minute to 100 lb. per square inch gauge pressure and deliver the same to a drill in the mine; that the power cost is 1c. per horse power hour; that a drill which shows a drilling speed of 10 in. per minute on test averages 20 ft. per hour under working conditions, and uses 60 cu. ft. of free air per minute on test; that another drill will show a drilling speed of 6 in. per minute on test with an air consumption of 36 cu. ft. per minute and will average 12 ft. per hour under working conditions, and that the wage scale for drill runners is 40c. per hour, then,

For the fast drill:

$t = 1$ min.

$d_1 = 10$ in.

$L = 40$c.

$$O_1 = 20 \div \frac{10 \times 60}{12} = 0.40$$

$$p = \frac{30 \times 1}{60} = 0.5\text{c.}$$

$v_1 = 60$

$$F_1 = \frac{d}{0.2\frac{L}{O_1}t + 0.12\,pv_1} = \frac{10}{\frac{0.2\text{x}40\text{x}1}{0.40} + 0.12\text{x}0.5\text{x}60} = 0.424$$

$$F'_1 = \frac{1}{\frac{0.20\,tL}{O_1d_1} \times \frac{0.12\,pv_1}{d_1}} = \frac{O_1d_1^2}{0.024\,tLpv_1}$$

$$= \frac{0.40 \times 100}{0.024 \times 1 \times 40 \times 0.5 \times 60} = 1.389$$

For the slow drill:

$d_2 = 6$ in.

$v_2 = 36$ cu. ft.

$$O_2 = 12 \div \frac{6 \times 60}{12} 0.40$$

$$F_2 = \frac{6}{\frac{0.2 \times 40 \times 1}{0.40} + 0.12 \times 0.5 \times 36} = 0.271$$

$$F'_2 = \frac{0.40 \times 36}{0.024 \times 1 \times 40 \times 0.5 \times 36} = 0.833$$

Thus the relative factors for the two drills by the first formula have a ratio of 0.424 to 0.271 or 1.56 to 1; and by the second formula (empirical) the ratio of factors is 1.389 to 0.833 or 1.67 to 1. In other words, by the empirical formula the fast drill is credited with about a 7 per cent. higher rating than by the theoretical formula, and this does not seem an undue allowance to cover the unestimated advantages previously enumerated.

Records made previous to July, 1909, have not been shown in Table I. since much of the work done in 1907 and 1908 was distinctly experimental in determining the desirable cylinder diameters, lengths of strokes, piston weights, valve weights, etc., but such records show drilling speeds of about 2 to 3 in. per minute with air consumptions of from 40 to 70 cu. ft. of free air per minute at 90 lb. per square inch gauge pressure. The listed tests made during 1909 cover most of the well-known American makes of hammer drills at that time, and if one excepts the drills denoted by symbols G, G_1, etc., since they were experimental tools, the design of which was developed by the New Jersey Zinc Co. at Franklin Furnace, N.J., it is noticeable that about 4½ and 5 in. were the highest drilling speeds obtainable at about 90 lb. pressure and with an air consumption of 60 to 90 cu. ft. or free air per minute; and for various drills the "factor" varied from 0.09 to 0.41. Those drills marked G, which were made exclusively for the New Jersey Zinc Co., increased the drilling speed about 40 per cent. above the best previous drill performances, and remained unequalled in drilling speed for a year and unsurpassed for about a year and a half. The fact that a number of these drills were included in the equipment at Franklin accounts for part of the increased stoping efficiency during the year 1911, as cited later. Although it was then the opinion of some unprejudiced persons, well versed in the drilling art, that such tools had reached their practical limit of drilling speed as well as the limit of strengths of materials, yet 18 months later a new type of drill was developed to achieve 20 per cent. more drilling with twice as good a factor, and a renewed equipment of these other drills again increased the mining efficiency. Again a period of 18 months sufficed for the production of a hammer drill which still further advanced the drilling speeds 20 per cent., and since the introduction of this drill we have been able to find several drills which surpassed it 10 to 20 per cent. in drilling speed.

In Table I. some seemingly freak runs are noticeable, which are included to call attention to the variability of results in presumably standard testing. For instance, under drills D it appears that a bit with two wings broken will drill faster and at a lower air consumption per minute than can be attained with a perfect bit; and again, with drill M_1, a bit which has proved a little soft and battered drills one-fourth more per minute than bits in proper condition and with the same air consumption.

Furthermore, the tests of one person indicate that, when the size and form of the drill bits are the same, faster drilling can be done with short steels than long ones, while another investigator shows a greater drilling speed with long steel than with short. The use of tappets or anvil blocks between the shanks of drill steels and pistons is generally estimated as causing a reduction of 20 to 30 per cent. in the drilling ability, but some tests do not confirm this and show even an increased cutting speed with the use of anvil blocks in a machine otherwise the same. With some drills the use of water to clean the cuttings from the hole seems to cause a cutting speed below that obtainable through the use of compressed air for the same purpose, but in other instances the advantages are reversed. In short, there seem to be so many variables in the drilling problem as to warrant a 10 per cent. variation in the results of supposedly standard tests, and a number of runs should be made to gain a fair average; or strict judgment of machines should not be made within this limit.

(To be continued.)

PERSONAL AND GENERAL

Mr. R. B. Lamb, of 501 Traders Bank Building, Toronto, is in California making an examination of two gold properties for investors.

Professor A. P. Coleman has returned to Toronto from Australia. He spent several months abroad.

Mr. J. W. Boyle, long actively connected with gold mining in Yukon Territory, arrived at Vancouver, B.C., from Dawson on January 31, on his way East.

Mr. E. P. Mathewson, of the Anaconda Copper Mining Co., was a recent visitor to Rossland and Trail, British Columbia.

Mining Press said editorially on January 30: "Arrangements have recently been completed whereby Mr. T. A. Rickard, editor of the Mining Magazine, will return to San Francisco, within the next few months, as editor of the Press, and Mr. H. Foster Bain will go to London as editor of the Mining Magazine."

Mr. Robert C. Sticht, general manager for the Mt. Lyell Mining and Railway Co., Ltd., left San Francisco, California, by the SS. Ventura on January 19, on his return to Queenstown, Tasmania, after having spent a vacation of several months in the United States.

Mr. F. M. Sylvester, general manager for the Granby Consolidated M. S. and P. Co., Ltd., is in New York City. He expects to return to Vancouver, B. C., about the end of February.

Mr. John Whittaker, manager for a company operating a coal mine in Yukon Territory, arrived at Vancouver, B.C., from the North on January 26.

Mr. Conrad Wolfle, manager for the United Copper Co., which is operating a copper mine near Chewelah, Washington, U.S.A., ore from which is being shipped to Trail, B.C., was at Rossland and Trail recently. He was met in the former city by his brother, Mr. F. R. Wolfle, manager for the Florence Silver Mining Co., which is developing a silver-lead mine in Ainsworth mining division, B.C.

Mr. Howland Bancroft, of Denver, Colorado, has been on a trip through mining districts in British Columbia. On his return to Colorado he resumed his professional work in that state.

The Western branch of the Canadian Mining Institute will shortly hold one of its periodical meetings, this time in Victoria. The date will probably be during the first week in March. Papers on Mine Timbering and First Aid to the Injured, having particular reference to instruction of metalliferous miners in this work, have already been promised; also a description of a recently constructed reinforced concrete and steel bankhead at a British Columbia coal mine. It is expected, too, that there will be discussion on Oxygen-Breathing Apparatus for Mine-rescue work.

Mr. David Fasken has returned to Toronto after visiting the property of the Nipissing Mining Co. at Cobalt.

Col. Carson, president of Crown Reserve Mining Co., who returned from England to attend the annual meeting of shareholders has left again for the front.

Col. Gear, a director of Crown Reserve, will command the 1st Battalion of the Montreal Home Guards.

Mr. B. A. C. Craig is a lieutenant in the second Canadian Contingent which will soon be on its way across the Atlantic.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND ELK LAKE

Power.—The companies of the camp are taking their turn in shutting down owing to shortage of power. While the weather has been moderate there has been no thaw which would affect the streams and there is not likely to be until April. Some of the companies are taking their enforced vacation of three weeks altogether, and so shutting off expense and taking the occasion to do needed repairs and make alterations. Others are closing down for a week each month and others again are idle for three days at a time twice a month. While the interruption of operations is very annoying to all the companies it is not so much resented as if silver had been at normal figures. It is felt that with the war over there must be a return of better prices and meanwhile the silver is in the ground; but on the other hand while the mills and mines are idle the overhead expenses continue.

Market for silver.—The price of silver has shown little change. There does not appear to be room for either undue pessimism or extravagant optimism in regard to the situation. There seems to be a disposition on the part of buyers to purchase outright rather than store or make part payment. This would lead to the belief that there is no uneasiness that the silver cannot be absorbed by the market. On the other hand when the market does show a tendency to advance a hoard of some million or two ounces is loosed and it falls again. There has been good buying from China and some from India, though the demand from India is rather disappointing. On the whole there is no disposition to believe that there will be any marked change in the situation until the war situation itself shows a marked change. The price of silver is inextricably bound up with the fortune of the Allies.

Beaver and Timiskaming.—The development of the new ore bodies on the Beaver and the Timiskaming has been of very considerable importance. The vein is still good in both faces and some very rich ore is being mined. As regards the Beaver it is by no means new. The same vein is being worked to-day on three levels, the 400 ft., the 460 and the 530 ft. But on the Timiskaming it is opening up virgin territory. The vein was followed across the Beaver line at the 530 ft. level and soon after the boundary was crossed a very rich pocket was struck. It has now been drifted upon for 80 ft. into the Temiskaming and the vein while split in the face is still quite good. The values are variable; but the ore is always

of excellent shipping quality and some of it is as remarkable ore as has ever been mined in the camp. All the ore is at present being brought up the Beaver shaft, trammed to the old ore house of the Beaver and teamed across to the Temiskaming. On the Beaver the same vein on the 530 ft. level has been followed for 155 ft. The shaft is now down to the 800 ft. level on the Beaver and a raise is being made from a crosscut. Work from the 530 ft. level of the Beaver mine is now being carried on on the Temiskaming by the Beaver company, the Beaver receiving a certain price per ft. for all rock drilled. At the Temiskaming crosscuts have been started from the 400 and 500 ft. levels to cut the vein found from the Beaver. It is expected that at the present rate of progress it will be possible to hoist the ore through the Temiskaming shaft in a month's time. Below the 750 ft. level of the Temiskaming a winze has been sunk to the 800 ft. There is a short ore shoot of very rich ore at the 750 ft., but it is lean in the winze. Drifting on the vein in the first part of the month was beginning to show very satisfactory results. As this is in the diabase several hundred feet below the Keewatin the results will be awaited with interest. The new ore body is running in a southerly direction parallel to the old vein system and about 300 ft. distant from it.

Both the mills at the Temiskaming and the Beaver are running to capacity. The ore bins at the Beaver in particular have been full to overflowing for some time. The Beaver and the Temiskaming have been shut down for three days already this month and will close down for three more days at the end of January.

The shortage of power is hindering the reopening of some old prospects. The York Ontario would have started up the old King Edward mine if they could have obtained power some time ago, and the Right of Way company had determined to make another attempt at finding ore, but there was no means of obtaining power and the compressor was sold some time ago.

Crown Reserve.—Ore reserves at the Crown Reserve are estimated at 1,500,000 ounces. When the report was made it was estimated that no ore had been put in sight during the year, and that therefore the output of 1,425,320 ounces reduced the ore reserves by that amount. Since then there have been some rather promising developments on the Crown Reserve itself and the discovery on the Silver Leaf in which the Crown Reserve has a 65 per cent. interest, is still holding good. The cost per oz. at the Crown Reserve was 28.95 cents, an increase of nearly six cents during the year. The profit per oz. was 22.97 cents, as against 36.43 cents for the previous year. The total ounces mined since the inception of the company is 18,429,141, of which the Carson vein produced 9,015,279 ounces. On the Silver Leaf lease $16,659 was expended during the year and a good find made. On the Drummond Fraction, worked jointly with Kerr Lake, a production amounting to $60,717 had been made, leaving a profit of $12,309.

Canadian Mining Institute.—At a meeting of the Cobalt branch of the Canadian Mining Institute the members present unanimously decided that it would be better to leave the by-laws of the Institute as they were for a year when the proposed alterations might be taken up again. The following resolution was proposed by Mr. E. V. Neelands, seconded by Mr. T. R. Jones, and carried unanimously:

"Whereas important amendments to the by-laws have been proposed, radically altering the present method of election of council and whereas this is an abnormal year on account of the war and many members will likely be hindered from attending the annual meeting, and whereas a considerable number of our members are at the front and cannot therefore vote, be it resolved that consideration of these important amendments be postponed until the annual meeting of 1916."

It was also unanimously resolved to circulate the resolution for the signatures of members not present at the meeting and to send a copy of it to all other branches of the Institute.

Some discussion preceded the passing of the resolution. Mr. B. Neilly, who was in the chair said that on the basis of the proposed amendments to the by-laws Ontario would have the absolute control of the council. If a heated debate took place at the annual meeting and the amendments went through it was quite probable that the Nova Scotia society would not come in and the Rocky Mountain branch would secede, as it would reduce their representation to almost nothing.

Mr. Neelands said that if the resolution went through Ontario would undoubtedly be accused of hogging the whole business.

Mr. E. B. Thornhill, superintendent of the Buffalo mill then gave an important paper on "The Recovery of Mercury from High Grade Residues." By the aid of the blackboard and demonstration he proved his contention that a great saving in mercury could be made by the process that he has discovered at the Buffalo mill. There was some discussion, Mr. Denny, of the Nipissing staff, taking the lead.

Mr. T. R. Jones, manager of the Buffalo mines, pointed out some of the economic advantages of the process. He said that it had reduced the loss in mercury from 50 pounds to the ton by 70 or 75 per cent., and it had reduced the cost of the treatment of the concentrates from $18 to $25 a ton. A very ready market was also found for the product, it being more free from impurities than commercial mercury, and he hoped that they would soon be able to get a premium on it for that reason. They had recently sold some for electrical transformers and the purchasers seemed much pleased with the product. The cost of the installation of the plant for treating the mercury was slight and inconsiderable.

A hearty vote of thanks was passed to the lecturer for his most interesting address.

PORCUPINE AND KIRKLAND LAKE

Tough-Oakes.—At the annual meeting of the Tough-Oakes mining company in Haileybury at the end of last month the old directorate was elected. It was reported that there was an ore reserve in the mine of a million and a half dollars. It is confidently expected that the mill will be running by the middle of March. Three or four drills are now at work underground.

Hollinger.—The annual report of the Hollinger was read with great interest in the camp largely owing to the information given as to the diamond drilling. This has been a matter of excited speculation for the better part of a year; but the secret had been so well kept that no exact details ever became general knowledge. It now appears from the annual report that the hole was driven to an inclined depth of 2,000 ft. and a vertical depth of 1,425 ft. The results as given can only be taken as conclusive that the same formation continues for 1,500 ft. and that there is ore, presumably of a fair grade. Other experience of diamond drilling in the camp leads to the conclusion that average results are generally below the actual value of ore rather than above it. Mr. Robbins states that the records obtained are about what he would have anticipated from diamond drill cores on the same grade of ore that he is now

working. And therefore under the heading of "speculative," he states "that it is not unreasonable speculation to anticipate from the ore bodies now being worked a production of something over twice the value of the ore shown in the estimate of ore reserves. Beyond this are the possibilities of production from the veins not yet developed, and also the value of ore which may be encountered at levels below the depth of the bore hole."

Wettlaufer gold.—The Nipissing Mining Company has taken an option on the Wettlaufer property which adjoins the Teck-Hughes. Development of the Teck-Hughes is proceeding quite satisfactorily. The plant of the Kirkland Lake gold mines has been leased in order to provide further power for more extended operations on the Teck-Hughes. On the lower level 88 ft. of drifting has been done on a wide vein of low grade ore.

Rea.—The success of the Rea Mines Leasing Company is reflected in the 6 per cent. dividend which has just been declared. This company took over the Rea from the Mines Leasing Company and has been running the little mill purchased from the Porcupine Pet at a profit ever since. The ore run is that blocked out by the old company in the early days, and during the past year the little mill has made a profit of $50,000. The mill makes an extraction of 87 per cent. on $8 to $10 ore. No new ore bodies have been found by the leasing company.

Porcupine Crown—The annual report of the Porcupine Crown mine shows that the property made an excellent recovery during the last four months of the year after a rather disappointing eight months. Mr. Summerhayes writes: "During the first eight months of the year the development was very discouraging, both in proving beyond the fault and on the 500 ft. level. The last four months of the year has not only proved the existence of ore at 500 ft., but has been most satisfactory south of the fault, and as a result at 300 ft. there is a 1,000 ft. ore shoot."

But south of the fault the vein is not as rich.

Ore reserves are estimated at 85,000 tons, valued at $1,510,000. The average heads were $17.18 per ton.

BRITISH COLUMBIA

East Kootenay.

The only ore shipper in this district during the first three weeks of the new year was the Sullivan group, which sent 2,115 tons of lead-silver ore to Trail.

The Kootenay Central Railway, the construction of which was completed recently, is now being operated, trains being run from Golden south up the valley of the Columbia river on stated days. There is also a regular schedule from the Crowsnest Railway line northward, up the valley of the Columbia. It is expected that the opening of this railway for traffic will lead to some of the lode mining properties in Windermere mining division being worked after having lain idle for many years.

West Kootenay.

Ainsworth.—With the exception of a carload shipment each from the Early Bird, situated on the western shore of Kootenay lake, near the town of Ainsworth, and the Utica, on Paddy's Mountain, there was not any ore received from mines in Ainsworth division at the smelting works at Trail up to January 22. Development work is being continued on the John L. Retallack & Co.'s Whitewater group, and on other mines in the division. With the return of spring ore production will be resumed, though probably on a comparatively small scale until market conditions shall improve and the sale of silver, lead and zinc be remunerative again.

Slocan.—Ore was received at Trail from five mines in this division during three weeks to January 22. From the Hewitt mine and concentrating mill, owned by the Silverton Mines, Ltd., 64 tons was received; from the Idaho-Alamo, west of Three Forks, lessees shipped 58 tons; from the Mercury, which had not been on the shipping list for a year or more, 17 tons was received; the Rambler-Cariboo sent out 117 tons, and the Reco made a new beginning with a car of 32 tons.

The Ivanhoe concentrator has been working on ore from the Surprise mine, and the concentrated product made is finding a market at Newark, N.J. The Surprise is one of the few mines in the district at which operations were continued uninterruptedly throughout the year, war troubles not having affected the carrying out of the development and production policy of the owners.

Nelson.—A car of concentrates has been sent from the Granite mill to Trail, the Granite-Poorman property having been leased by an enterprising resident in Nelson, Mr. J. P. Swedborg, who has had men at work in the mine through the winter, and latterly has been crushing ore in the mill.

Lead ore is still being shipped to Trail from the Emerald and H. B. mines, near Salmo; from the former there was received 126 tons and from the latter 123 tons. The Leadville, in the same part of Nelson division, has made its first carload shipment. Gold concentrate from the Queen mine, at Sheep creek, has also been going to Trail as usual; the output of that mine in 1914 was 5,517 oz. of gold and 1,557 oz. of silver from 9,801 tons of ore crushed.

Rossland.—The output of ore for the first three weeks of the year has averaged nearly 7,000 tons a week, of which 3,800 tons a week was from the Centre Star-War Eagle group and 2,760 tons from the Le Roi, the remainder having been from the Josie mine of the Le Roi No. 2, Ltd.

Approximate figures of production in 1914 are as follows: Ore, 295,000 tons. Metal contents: Gold, 140,-080 oz.; silver, 133,460 oz.; copper, 5,138,000 lb. The shipping mines were: Centre Star-War Eagle group, 174,000 tons; Le Roi, 97,000 tons; Josie group, 24,000 tons. The smaller part of the ore from the Josie group was second-class ore and was concentrated, and the concentrate as well as the first-class ore was sent to the smeltery at Trail.

The payroll for December at the Consolidated Mining and Smelting Co.'s works—copper and lead smelting and electrolytic lead refining—at Trail is stated to have been about $57,000, with about 600 men employed.

Boundary.—At several small gold properties in the neighborhood of Greenwood, men are now working; not many at each, but an appreciably large number altogether. Among these are the Prince Henry, Strathmore, E. P. U., and Argo. Both the E. P. U. and Strathmore have recently taken out ore for shipment to the smeltery, and it is expected the others will shortly follow suit.

The Granby Consolidated Co. is working its mines near Phoenix and smeltery at Grank Forks, though not yet at full capacity. With copper now bringing a higher price than it was when work was resumed in December, the outlook for enlarged operations is brighter. The British Columbia Copper Co.'s smelting works at Greenwood are still idle. The Jewel gold mine and stamp mill are being operated; revised returns show a total production from this mine in 1914 of 16,526 tons of ore, from which there was recovered 6,512 oz. of gold and 33,236 oz. of silver.

MARKETS

TORONTO MARKETS.

Feb. 10—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 9 cents per lb.
- Lead, 5 cents per lb.
- Tin, 39½ cents per lb.
- Antimony, 19 cents per lb.
- Copper, casting, 15½ cents per lb.
- Electrolytic, 15½ cents per lb.
- Ingot brass, yellow, 10c. per lb.; red, 12 cents per lb.

Feb. 10—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $8.00 per ton.
- Coal, bituminous, $5.25 per ton.

GENERAL MARKETS.

Feb. 8—Connellsville coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.55 per ton.
- Foundry coke, prompt, $2.00 to $2.50 per ton.

Feb. 8—Tin, straits, 37.12½ cents.
- Copper, Prime Lake, 14.50 to 14.75 cents.
- Electrolytic copper, 14.50 to 14.60 cents.
- Copper wire, 15.75 to 15.87½ cents.
- Lead, 3.80 to 3.85 cents.
- Spelter, 8.25 cents.
- Sheet zinc (f.o.b. smelter), 11.00 cents.
- Antimony, Cookson's, 19.50 to 20.00 cents.
- Aluminum, 19.00 to 19.50 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, soft, $43.00 to $44.00 per ounce.
- Platinum, hard, 10 per cent., $47.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $56.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
January—		
23.	48¾	22 11/16
25.	48⅞	22¾
26.	48⅞	22¾
27.	48¾	22⅝
28.	48¾	22⅝
29.	48¾	22⅝
30.	48⅝	22⅝
February—		
1.	48⅝	22⅝
2.	48⅜	22⅝
3.	48	22½
4.	48¼	22⅝
5.	48¼	22⅝
6.	48¼	22⅝
8.	48⅛	22 9/16

STANDARD EXCHANGE.

Toronto, Feb. 9, 1915.

Cobalt	Sellers.	Buyers.
Bailey	.01⅞	.01¾
Beaver	.28	.27¼
Buffalo	.90	.60
Chambers-Ferland	.15	.13
Coniagas	5.50	...
Crown Reserve	.75	.69
Foster	...	.02
Gifford	...	.01
Gould	.00¾	.00½
Great Northern	.04	.03¾
Hargraves	.01½	.01
Hudson Bay	40.00	...
Kerr Lake	4.80	4.50
La Rose	.72	.68
McKinley-Darragh-Savage	.46	.42
Nipissing	5.55	5.40
Peterson Lake	.24¼	.23¾
Right of Way	.02¼	.01¾
Seneca Superior	1.30	1.05
Silver Leaf	.03	.02½
Silver Queen	...	.02
Timiskaming	.17¾	.17½
Trethewey	.14	.10½
Wettlaufer	.06	.04½
York, Ont.	...	.05
Porcupine—		
Apex	.02⅛	.01⅞
Dome Extension	.07⅝	.07¼
Dome Lake	.29¾	.29¼
Dome Mines	6.75	6.00
Foley O'Brien	.20	.15
Gold Reef	.03½	...
Homestake	...	.10
Hollinger	22.70	22.50
Jupiter	.10½	.10
McIntyre	.27	.26¼
Pearl Lake	.02¼	.01½
Porcupine Crown	.84	.80
Porcupine Gold ex-r.	.00⅜	.00⅛
Porcupine Imperial	.01⅝	.01½
Porcupine Pet	...	.17
Porcupine Vipond	36½	.35½
Preston East D.	.02	.01½
Rea Mines	.20	.12¼
Teck-Hughes	.11¾	.11¼
West Dome	...	.08
Sundry—		
C. G. F. S.	.04¾	.04⅜

COBALT SHIPMENTS.

Four hundred and forty-four tons of ore was the Cobalt total for the week ending Feb. 5, 1915. These figures are the largest, save one, of any week in the past few months and represent 13 cars shipped from eight mines. Bullion shipments for the week were lower than last week, three companies shipping over 100,000 oz.

The Mining Corporation of Canada was the heaviest shipper in the week. From the Townsite-City mine, 256,815 lb. was shipped in three cars of high grade and concentrates. From the Cobalt Lake one car was sent to Deloro. Dominion Reduction had two cars to Denver during the week, while Coniagas and Trethewey each shipped two cars of high, the former shipped to Thorold and the latter to Deloro and Denver. From the Kerr Lake section the Timiskaming sent out a car of mixed concentrates and high grade to Denver and the Kerr Lake shipped to the same point.

Nipissing does not appear as a bullion shipper this week, and as a result the totals are lower than usual. The Dominion Reduction, Caribou-Cobalt and Crown Reserve sent out 109,000 oz. valued at $54,600 during the week.

Ore shipments for the week were:

Mining Corporation of Canada—	
Townsite-City	256,815
Cobalt Lake	65,650
Coniagas	115,061
Dominion Reduction Co.	172,400
Trethewey	86,791
McKinley-Darragh	84,030
Kerr Lake	50,520
Timiskaming	57,335

—Cobalt Nugget.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Graham, S. N.
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DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Summary Report of the Geological Survey for the year 1913.

NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

QUEBEC
Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.

ONTARIO
Museum Bulletin No. 5. A Beatricea-like Organism from the Middle Devonian, by Percy E. Raymond.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES
Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.
Memoir 61. Moose Mountain District, Southern Alberta (Second Edition), by D. D. Cairnes.

BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.
Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.

YUKON AND NORTH-WEST TERRITORIES
Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.

QUEBEC
Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

BRITISH COLUMBIA
Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.
1321. Diagram Showing the Geology of Texada Island, British Columbia.
Map 106A. Groundhog coal field, British Columbia. Geology.

YUKON AND NORTH-WEST TERRITORIES.
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.
Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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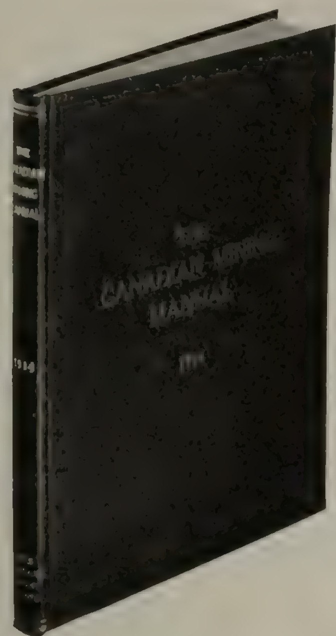

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The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

ALPHABETICAL INDEX TO ADVERTISERS

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MARCH 1, 1915 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 5

The Canadian Mining Journal, 2nd Floor, 44-46 Lombard St., Toronto, Ont.

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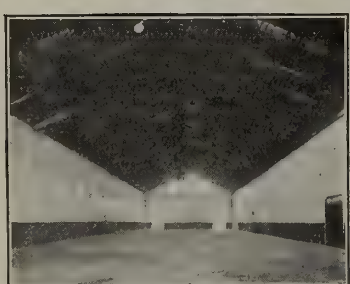

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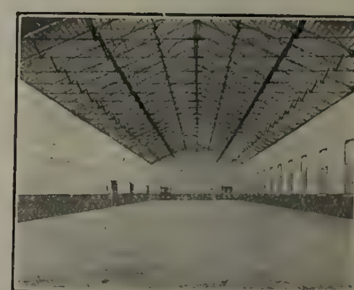

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THE CANADIAN MINING JOURNAL

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Editor
REGINALD E. HORE

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CONTENTS.

CANADIAN MINING INSTITUTE ANNUAL MEETING

The seventeenth annual meeting of the Canadian Mining Institute will be held in Toronto March 3rd, 4th and 5th. The program is an interesting one, and the attendance should be large.

We wish to call the attention of our readers to the fact that the Canadian Mining Institute is not merely a technical society and that membership is open to mining men of all classes. One of the main objects of the Institute is to further the Mining Industry of Canada, and it is recognized that technical men are not the only ones interested in the success of the Industry. In addition to mining engineers, metallurgists, geologists, surveyors and chemists, the list of members includes many non-technical men, such as mine owners, directors of mining companies, holders of stock in mining companies and others. In short, the Institute represents the Mining Industry, and not merely the Mining Profession.

And we wish also to call the attention of our readers to the fact that the sessions to be held at the King Edward hotel this week are open to non-members. Visitors will be welcomed. If you are a reader of this Journal you are interested in mining. If you are interested in mining you will with profit to yourself attend the meetings of the Canadian Mining Institute.

And we wish also to call attention to the fact that the Toronto committee expects members to bring their ladies with them. The ladies will not be interested in the technical sessions; but they will be interested in the programme prepared for them by the ladies' committee.

We hear it stated occasionally that, owing to the war, attendance at this year's meeting will be smaller than usual. Possibly that is so; but it is probable that the effect of the war on the meeting will not be just what such persons expect. There is in the serious situation in which the Empire finds itself something that fosters the 'get-together' spirit. Canadian mining men will be glad of the opportunity to attend a banquet where there will be so much of meaning in the toast, "To the King."

COAL IMPORTS AND EXPORTS

The new war taxes seem to have been excellently well thought out, and should distribute the burden of raising additional money for Government purposes very equitably over the population, but, from the viewpoint of the producers of soft coal in Canada, the exemption of anthracite coal from the 7½ per cent. additional impost,

seems hardly necessary, at any rate, in that portion of Canada where anthracite coal is a strong competitor of Canadian mined soft coal. Very little attention has so far been paid by Canadian operators to the possibilities of the substitution of coke made from soft coal for anthracite. Generally speaking the use of coke has not been popularized in Canada, but for certain classes of heating, particularly office and domestic heating, coke, burnt in a slow combustion tubular stove, is an admirable fuel. It is lasting, smokeless, and produces a hot fire which needs very little attention, and is moreover economical.

The action of the Canadian Government in exempting anthracite coal from taxation is in marked relief to the attitude of one of the United States coal trade papers in connection with the importation of Nova Scotian coal into Boston. A very limited amount of business has been taken by Nova Scotian companies in competition with United States coal. The business was fairly obtained by actual tests, and it has, of course, only been possible for the Nova Scotian coal companies to obtain the business by quoting a very low figure. The incident has called forth very spiteful comment. A country which imports into Canada nineteen million tons of coal annually should be a little tolerant of so trifling competition as comes from Nova Scotian coal in the New England markets.

The imports of coal into Canada during the years 1909 to 1913 were as follows. Practically all this coal came from the United States.

	Tons.
1909	10,372,924
1910	11,096,936
1911	15,310,281
1912	15,223,984
1913	18,925,859

Canadian coal exports during the same period were as under:

	Tons.
1909	1,749,197
1910	2,377,049
1911	1,634,582
1912	2,173,839
1913	1,631,586

These figures show a very one-sided tendency, and when it is further remembered that the coal production of the United States approaches 600,000,000 tons per year, while that of Canada barely exceeds 15,000,000 tons, it seems very undignified for United States operators to squeal so loudly when a little Canadian coal is sold in Boston. It used to be remarked of the Dutch that in business they had the failing of giving too little and asking too much. There are others.

F. W. G.

THE REFINING OF NICKEL

The Ontario Government has announced that it will appoint a commission to enquire into the problem of refining nickel in Canada. Some of the newspapers would have us believe that there is no problem at all, that the Government should just prohibit the export of nickel matte, and that as a result the nickel companies would necessarily do the refining in Canada.

With this stand of some of the newspapers, that Canada should wholly disregard the interests of companies that have large sums of capital invested in the industry, we have no sympathy at all. Nor do we believe that the situation calls for the lack of confidence in the Governments at Ottawa and Toronto that is expressed in such demands.

Now that the announcement has been made that the question of nickel refining is to be investigated, we find these papers complaining that an investigation will take a long time, and that the war may be over before the report is ready. If the investigation is to be of any value it should take a long time. The problem will require careful study from many sides. As great speed as is possible, with due regard for the importance of the report, should be demanded of the commission. But to ask the commission to report in a few weeks would be equivalent to instructing the members to report without an adequate knowledge of the facts.

Some interesting comments on the nickel question by an outsider are contained in an editorial in our esteemed contemporary, the Mining Press, San Francisco. Mining Press, Feb. 13, 1915, says:

"Canada is populated with loyal sons of the British Empire, and it also produces a considerable part of the world's supply of nickel, which is used in making armor plate for war vessels, and to a minor degree in the manufacture of munitions of war, such as nickel-jacketed bullets. In the early days of the war the idea occurred to Canadians that possibly some of the nickel employed by the enemies of Great Britain was derived from Canada, and by reiteration the fear grew until it became an obsession. Not long ago a Montreal daily paper published a cartoon showing a British battleship being torpedoed by a German submarine, with the accompanying legend, 'Sunk by Canadian nickel.' That neither torpedoes nor submarines contain appreciable amounts of nickel is a mere detail; the underlying idea is a patriotic one, which must be regarded with respect.

"The two producers of nickel in Canada are the Mond Nickel Company, Ltd., and the International Nickel Company. The former is a British corporation which refines its nickel in Wales, and, being under the direct control of the British military authorities is, of course, beyond suspicion. The International Nickel Company is an American corporation which refines its nickel in New Jersey, and the weight of suspicion at once fell upon it. It was at first rumored that the American company was controlled, or at least in part owned, by Krupp interests, but the most cursory investigation was sufficient to prove conclusively that such an assertion had no basis of fact whatever. It was next charged that the International Nickel Company was selling its product to for-

eign buyers, some of whom would presumably attempt to take advantage of the high prices in Germany by forwarding nickel to that country. Since the International Nickel had taken precautions, soon after the war broke out, to clear itself of any such suspicion by placing all its foreign business in the hands of its English agents, it was equally easy to show that this was also not the case. That these facts are fully recognized in well informed circles in Canada is made clear by the editorial comment in the January 15 issue of our excellent contemporary, the Canadian Mining Journal. It is now proposed, however, to force the International Nickel Company, by appropriate legislation, to abandon its refining plant in New Jersey and carry on its refining in Canada, thus placing the industry wholly within Canadian control. The problem thus at once passes out of the domain of national patriotism into the more exact one of economics, and the factors which govern the situation are business relations into which it will be profitable to inquire more deeply before taking action.

"During 1913 there was imported into the United States approximately 47,500,000 pounds of nickel in the form of matte. Of this about 3,000,000 was derived from New Caledonian ores smelted into matte near Antwerp, and forwarded to this country for refining in order to avoid the 10 per cent. duty imposed on imports of metallic nickel. The remainder was derived from Canada, and of the total amount of refined nickel produced, a little less than one-half was consumed in the United States and the remainder exported. Very little of this nickel was returned to Canada, only about one-eighth of one per cent. of the total. The fundamental question is therefore whether it is better economy to make Canada the production centre from which to export its entire product to the rest of the world (in the case of the United States in the face of an import duty), or to retain New York as a refining centre, with one-half the product for domestic consumption and only the remainder for export. Two factors must be considered—the relative cost of refining in the two places, and the trade conditions to be met in marketing the product.

"In a letter published in the Canadian Mining Journal of January 8, Mr. R. W. Leonard argues that refining can be done as cheaply in Canada as in New Jersey. It is difficult to see how such a thesis can be supported. As is well known, the production of nickel from matte involves several successive smeltings with salt cake, whereby the copper-nickel matte is separated into copper containing a little nickel and nickel containing a little copper. Fuel costs at Sudbury almost twice as much as in New Jersey; salt cake costs more than twice as much. We have not at hand any record of the average rate of wages paid at Sudbury and Bayonne, but the average daily wage paid to unskilled laborers in the vicinity of New York is \$1.75 to \$2 per day, according to figures furnished by the Bureau of Municipal Research. It is evident, therefore, that the labor cost would also be higher in Canada. To abandon refining in New Jersey and take it up in Canada would involve abandoning the New Jersey plant and constructing another in Canada; the cost of the new construction would have to be charged to the cost of refining in Canada, and it is difficult for the outsider to see how costs at the two places could be made anywhere near equal.

"Refined nickel produced in Canada, on entering the United States, would be subject to a duty of 10 per cent., or approximately \$80 per ton. In order to avoid this duty, one of the two French companies operating at New Caledonia, ships its ore to Holland, where nickel matte is produced that is shipped to New Brunswick, New Jersey, for refining; the refined nickel being sold in the United States in competition with the product of the International Nickel Company. To the unprejudiced outsider it would seem that if the International Nickel Company were obliged to remove its refinery to Canada, and attempt to reach the United States market in the face of a 10 per cent. duty, the French company would promptly increase its refinery capacity in this country and supply a larger part of the present demand. It is generally reported that the International Nickel Company has considerable holdings in the New Caledonian nickel region which it has not yet developed. If the French company can operate in the field of an old established company, it seems certain that the International Company would not abandon its New Jersey plant, but would instead supply it with enough ore or matte from its New Caledonia deposits to provide for the consumption of nickel in this country. In attempting to force the refining of Canadian nickel in Canada, it therefore appears as though our friends across the St. Lawrence would be doing something like killing the goose that laid the golden eggs; for it apparently means the abandoning of the United States as a market for Canadian nickel. Turning to the pages of history, we find that when a country has placed an embargo on any of its products, the net result almost invariably has been the ruining of home industry and the benefiting of foreign competitors. It seems probable that a similar result would ensue if the Canadian authorities should place an embargo on the export of nickel ore and matte."

While these remarks call attention to some of the factors not considered by those who have argued in favor of legislation against the outside companies, the remarks are open to criticism.

It is admitted that fuel and salt cake and labor would cost more at Sudbury, Ontario, than at Bayonne, New Jersey. But why choose such places for comparison? There are many places in Ontario where fuel and salt cake could be assembled at less cost and where labor is cheaper than at Sudbury.

And why should mention be made of the 10 per cent. duty on refined nickel without mentioning the 6 cents per pound bounty which the Ontario Government pays on nickel refined in Ontario. Surely the compensation is adequate. It is well to remember, however, that the bounty expires in 1917. The duty on refined nickel is one of the reasons why the bounty should be available for a longer period.

The method of refining nickel used by the International Nickel Co. at the New Jersey plant is more or less secret. From time to time there have appeared brief descriptions of the process used; but details are always lacking. Apparently the company avoids publicity for business reasons, and consequently no authoritative description of the plant has appeared.

However, some idea of the process may be obtained from a bulletin distributed by the Canadian Copper Co., in which Mr. Alex. Gray says:

"Briefly, the Orford process, as the court of last resort in the refining of nickel, is a chemical process conducted in a locality where there are sundry other scientific nuisances to which distance lends enchantment. The Orford works are close to chemical factories and oil refineries. The coke and coal used there would cost three

times as much if they were hauled to Sudbury or Copper Cliff, and then the assortment of unsavory flavors would doubtless suggest that the Orford Copper Co. should be bonused to return to Bayonne. In the smelting at the refinery the quantity of coke runs to about 40 per cent., and in the reverberatory work selected coal is necessary. In the final smelting of the nickel there must be a sulphur-free oil. Nickel cannot be smelted or heated for rolling with a sulphur-bearing oil.

"Refining consists, according to Orford practice, of several smeltings. First there is a smelting in a blast furnace with salt cake or sodium sulphate, the latter being reduced to a sulphide which forms, with the copper and iron sulphides, a fluid matte of lower specific gravity than the nickel sulphide. A crude separation is the result. The material is cast in pots. On cooling, the 'tops' or upper portion containing iron and copper sulphides with sodium sulphide and some nickel, and the 'bottoms' carrying most of the nickel with a small quantity of iron and copper, are easily separated by the blow of a hammer. Then the retreatment of the 'bottoms' begins. They are mixed with fresh salt cake and re-smelted, and the sulphide of soda liquates the copper from the nickel present, allowing the nickel to go to the bottom as nickel sulphide. Eventually, by means of careful adjustments, a pure sulphide of nickel is obtained. There are leachings with acids and Henderson roasts to eliminate the iron, copper and cobalt and a final reduction with charcoal in a reverberatory. The copper 'tops,' which contain 5 or 6 per cent. nickel, are re-melted in a cupola, and taken to a Bessemer converter, forming blister copper which is sent to the electric refinery. The copper slags go back to the matte cupolas. Altogether the metallurgy of the separation of nickel and copper is one of the most complicated problems in modern practice."

Further information concerning the process is contained in the following paragraphs from an application for a patent made by Mr. Ambrose Monell and published in the monograph on the Nickel Industry, written by Professor A. P. Coleman. The application says:

"In the reduction of ores containing nickel and copper where a matte is produced containing sulphides of nickel, copper, and iron, a process has been devised in which a separation of the nickel sulphides is effected by the use of sodium sulphide, advantage being taken of its power of dissolving the sulphide of copper and iron freely and forming a solution of less specific gravity than the nickel sulphide. The matte mixed with coke and sulphide of sodium has been charged into a cupola furnace. When this charge is smelted, the sodium sulphate is reduced by the coke to sodium sulphide and, forming a solution with part of the copper sulphide and iron sulphide, flows with the undissolved and melted sulphides of nickel, copper, etc., through the tap-hole, which is kept constantly open, into molds, where the molten constituents separate in accordance with their specific gravity, the sodium sulphide containing the dissolved copper and iron sulphides floating on the surface and the undissolved sulphides settling to the bottom. When the contents of the mold have solidified, the parts are separated by fracture and the tops containing the copper and iron are recharged into a smelting-furnace, where the sodium sulphide is fluxed off in an iron slag, being then lost. The bottoms contain most of the nickel sulphide of the original matte; but owing to the imperfection of the separation they also contain so much copper sulphide and iron sulphide that it is necessary to re-smelt them with fresh additions of coke and sodium sulphate, and thus to repeat the smelting and separation to the fourth or fifth time before the bottoms are brought to sufficient degree of freedom from iron and copper to enable the resultant nickel sulphide to be economically subjected to the succeeding steps of the refining process. The process as thus carried on is slow and wasteful and because of the cost of materials and the amount of labor and handling required adds greatly to the expense of the nickel and nickel oxide, which is the final product. I have discovered that these difficulties can be overcome and the separation rendered quick and inexpensive by the following process.

"Instead of smelting the compound matte, as heretofore, in a cupola furnace and running the product continuously into molds I so smelt the matte that when melted it will remain in a molten state subject to the high temperature of a furnace for a considerable period of time, during which I find that the copper and iron sulphides will be thoroughly dissolved by the sodium sulphide, and in one melting a good separation can be effected, and by two such treatments results are obtained equal or superior to the results of the four or five meltings which have been employed heretofore. For this purpose I employ as the smelting-furnace an open-hearth reverberatory furnace lined with magnesite brick, as I find that silica-lined furnaces are quickly destroyed by fluxing with the sodium sulphide. Into such furnaces I introduce a charge of nickel-copper-iron matte, either solid or molten, together with coke and sodium suphate, the latter being preferably present in the proportion of sixty per cent. of the weight of the matte and the coke in the proportion of fifteen per cent. of the matte. The sulphate is preferably added in the form of commercial niter-cake. Where, for example, a fifty-ton charge of matte is treated, containing say forty-five per cent. of nickel sulphide and thirty-five per cent. of copper sulphide, it is melted in the furnace and retained subject to the heat for some time—say four to five hours after fusion has occurred—during which time it is preferably 'poled'—that is to say, treated by immersing beneath its surface poles of green wood, which evolve hydrocarbon gases and vapors, and thus aid in the reduction of the sulphate and produce an agitation of the material, which facilitates and renders more thorough the solution of the sulphides to be removed. Nearly complete solution of the copper and iron sulphides in the sodium sulphide reduced from the niter-cake is thus effected, and the molten charge may be tapped from the furnace and allowed to separate in molds; but to get the best results I tap the different strata from the furnace separately, tapping first the solution of copper and iron sulphides floating on the surface of the bath and finally tapping the undissolved nickel sulphide, or the order of tapping may be reversed, the lower stratum of nickel sulphide being removed first. The great proportion of the iron and copper is thus separated, the nickel sulphide obtained being nearly pure. Where greater purity is desired, the nickel sulphide may be recharged into the furnace and treated again in like manner."

From these brief statements it should be evident that the cost of supplies and labor in the process must be very high. Convenience to the source of necessary supplies and cheap labor are naturally considerations of first importance in locating a plant where such a process is to be used.

Up to March 12, 1915, according to the estimates of the Monetary Times, $78,831,500 of war materials and equipment have been ordered by various Governments in Canada, since August.

INCONGRUITIES IN THE YUKON PLACER MINING REGULATIONS AND SUGGESTED REMEDIES

By J. A. MacDonald

The multiplicity of Placer Mining Acts and Regulations in the Yukon has given rise to much litigation and dissatisfaction among the miners. The difficulties met with by the surveyor of these claims in disentangling the various intermixed regulations cause profound irritation, from the fact that it is almost impossible to determine, *de jure* or *de facto,* the rights of ownership to many claims. It is said that in "every change of Federal representation a change in the mining regulations follows," *pari passu.*

Mining in the Yukon was of little consequence prior to 1897. At the time of the great rush in that year the old amended Act then obtaining was replaced by an entirely new one, known as Regulation Governing Placer Mining in the Yukon. This Act was in force, with some changes made in 1898, until three years later, when more changes were made. This 1901 Act did not meet with favor from the miners, and another new Act, entitled the "Yukon Placer Mining Act," was passed in 1906 and remains to the present day.

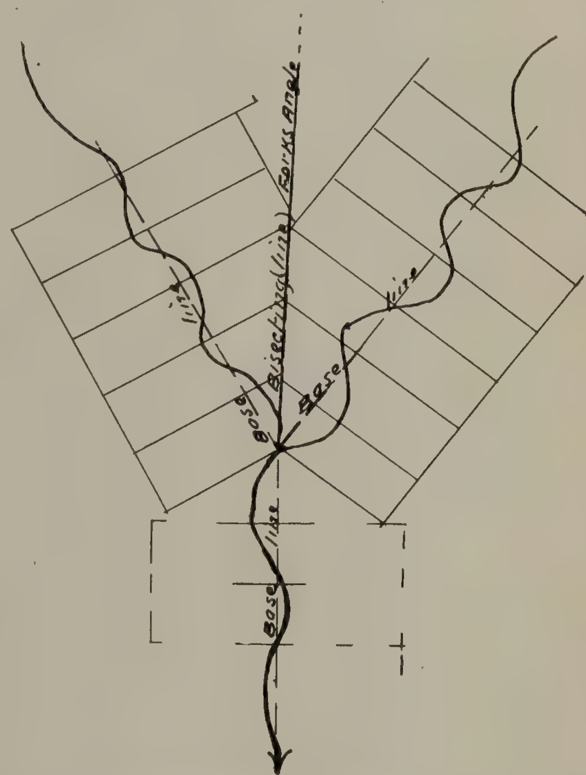
That these frequent and rapid changes in the mining regulations have caused endless litigation is not surprising.

In the Yukon, under the present regulations, Act 1906, a placer claim is to be staked out in the form of a rectangle 500 ft. wide along the general course of the

No. 1. Creek Forks Claims, Yukon

creek and with side lines extending 1,000 ft. on either side of the creek or base line. A base line is generally run along the general direction of the creek, and this base line forms the centre of the claim, as will be seen by the illustrations accompanying this article. There are numerous cases in which the rights of ownership to claims have never been defined, hence, possibly, so much legislation. These may be called "incongruities," a few of which are presented here. In at least two cases a remedy is suggested:

Exhibit 1.—Here we have what is called Creek Fork Claims. Suppose a creek forks, a base line is run up



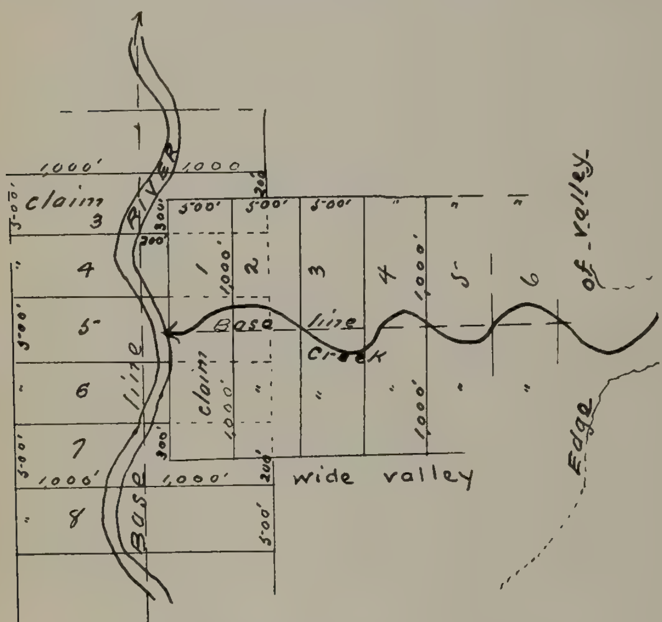
No. 1 A. Suggested method of laying out Creek Forks claims

each fork of the creek, a miner stakes a claim on one fork, being first on the ground, and his claim being as allowed by law, 1,000 ft. on each side of the base line, extends across the other fork, as shown in claims 5, 4 and 3, thus giving him two or more lengths of pay streak, each the length of a claim one on each creek. In the case shown Exhibit 1, the miner who staked out claim 5 possesses not only the full pay streak on his own creek base, but also two pay streaks on the other creek, rendering claims No. 6 and a good part of 7 almost worthless to their owners.

For, when No.'s 6 and 7 come along to stake out their claims, they find that Mr. No. 5 has run his stakes clean across the adjoining creek, and only a portion of a claim remains to be staked. No. 7 is very little better, for No. 5 on the adjoining fork has gobbled most of it up. No. 4, next him, has also a good part of two pay streaks, while the first three, 6, 7 and 8, are also unable to get a full claim, because 500 ft., along the base line, is the maximum length of a claim. The dotted lines of claims 6, 7 and 8 show the boundaries of their claims, as allowed by law. The illustration makes the case very plain in all its incongruity.

Exhibit 2.—Shows another incongruity. Here a small creek runs into a large one at right angles. The larger creek has a wide valley on the side upon which the smaller creek empties and its pay streak lies on that side. A miner stakes a claim along the smaller creek in the valley of the larger one (Claim 1), so that his claim of 1,000 ft. on each side of the base line along the smaller creek will include 2,000 ft. of pay streak of the larger creek, whereas the regulations are that such pay streak should be staked in claims of 500 ft. only.

It will be seen in this case that claim No. 1 takes up almost half of the pay streak of claims 3, 4, 5 and 6



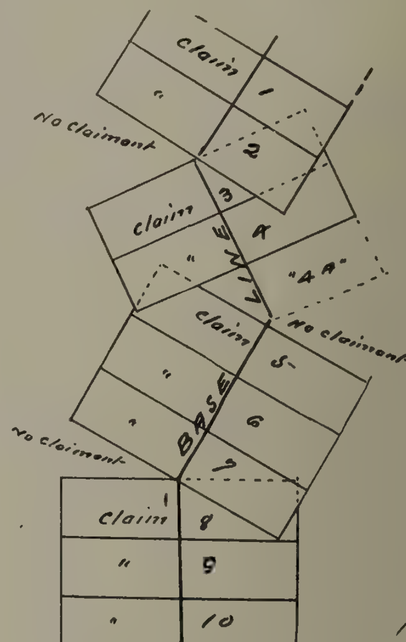
No. 2. Right angled creek claims, Yukon

along the large creek, a most unjust and unfair procedure, surely. A study of the plan, Exhibit 2, shows up this anomaly.

Exhibit 3.—Shows up another serious shortcoming in the regulations. There are the angles in the base line. The treatment of claims in the vicinity of such angles has given rise to many disputes. It is very difficult for the surveyor to adjust them in any way satisfactorily, for if the claims are staked according to the regulations, as they must be, there is necessarily overlapping at these angles, while there also remain parts not claimed by anyone.

Claims 1 and 2, which were first staked out or surveyed, have the full complement of area, while 3 and 4, notably 3, has but little more than half its size and area. The overlapping is shown by the dotted lines. The drawing makes this incongruity quite plain. There are other cases, but these three are sufficient for the present.

Suggested remedies.—Now, as to remedies: In the case of angles at the base line, Mr. Ogilvie, who spent many years in the Yukon, being the pioneer surveyor in that Northern region in the nineties and earlier, suggested, and in some few cases actually carried out, a remedy. Mr. Ogilvie simply split the angles at the base line corners, as shown in Exhibit 3 "A," and in this way utilized the corner vacancies shown in Fig. 3 "no claimant." This made irregular side lengths, but it gave the largest amount of fair play of any remedy yet suggested. By studying Fig. 4 "A" it will be seen that while the bases are equal the side lines are not as in Fig. 4. Take claims 1 and 2, in Fig. 4 they are rectangular with uniform boundary sides, while in Fig. 4 "A" the side lines are longer on one side than the other. Claim 3, as also claim 5, are gusset or jib shaped;

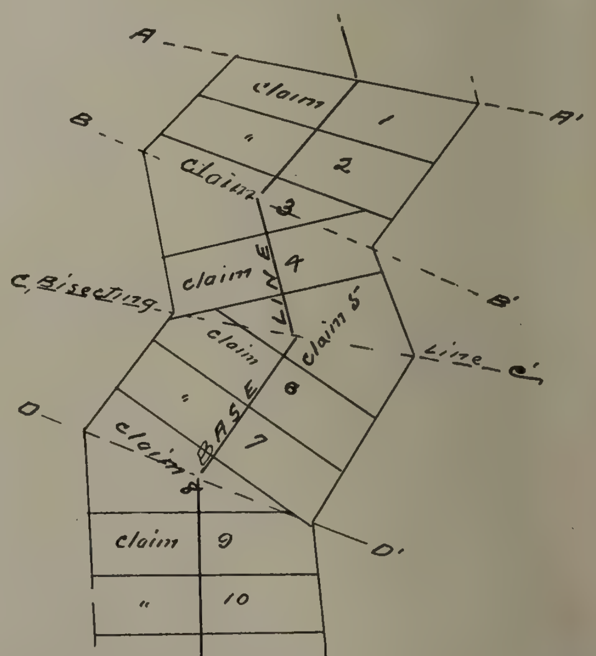


No. 3. Base angle claims

they have the complement of area, however, and there is no vacant ground at the angles. Strange to say, this remarkably overcoming-remedy, shown in 4 "A" as applied to 4, has not been incorporated into the Yukon regulations.

A, A1, B, B1, C, C1, D, D1 show the bisection, or split-line, of the angles.

Now as to case, Exhibit 1. The writer suggests a

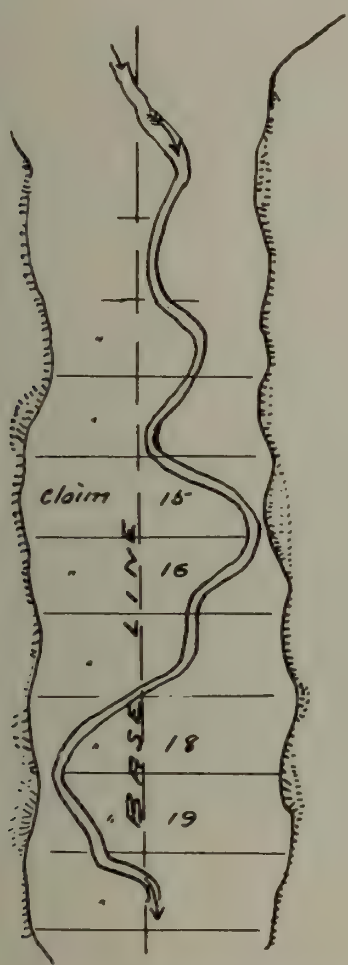


No. 3 A. Suggested remedy in case of base angle claims

simple remedy as shown in Exhibit 1 "A." This is simply split or bisect the angle at the forks by running a line in a direction which will divide the ground equally between the two creeks. In the case shown, 1 "A,"

this line need not be run more than 2,000 ft. In this each claim, on each fork, has fair play. The bisecting line forms the end boundaries of the adjacent claims, and there is no overlapping or no gobbling up of two pay streaks by greedy prospectors.

Fig. 5 shows another anomaly for which we do not see any remedy. The creek runs circuitously in the gulch, a base line is seen along its general course upon which the claims are staked. It is plain that those who have to take claims 18, 19, 15 and 16, where the creek runs to the sides of the gulch, are up against it. Mr. Thomas Fawcett, D.T.S., who spent several years in sur-



No. 4. Gulch claims, Yukon

vey work in the Yukon and who brought this anamoly to the writer's notice, could not offer any remedy.

Now, as to remedy for the incongruity in Exhibit 2. I have none, so far, to offer, though there is no doubt at all but some equitable arrangement could be made in the manner of staking out those right-angled creek claims which would make it worth while staking out claims 4, 5, 6 and, to some extent, 3 and 7, after claims 1 and 2 had been staked out on the smaller creek. That a remedy of some kind is urgent is quite apparent.

MINES BRANCH REPORTS.

The Mines Branch has issued recently the following bulletins: "The production of copper, gold, lead, nickel, silver, zinc and other metals in Canada during 1913," by Cosmo T. Cartwright, and "A general summary of the mineral production of Canada during 1913," by John McLeish.

U. S. MINE ACCIDENTS IN 1914.

It is gratifying to note that the fatalities in coal mines in the United States in 1914 were 334 less than during the preceding year, the total fatalities being 2,451, as compared with 2,785 for 1913.

According to Albert H. Fay, of the U. S. Bureau of Mines, the principal causes of accidents that show a material decrease were: Coal-dust explosions, 96 per cent.; haulage, 11 per cent.; and falls of roof and pillar coal, 10.6 per cent. The net decrease in underground fatalities was 365, or 14 per cent. This is equivalent to saving one life every day during the year.

There were 331 fatalities due to gas explosions as compared with 91 in 1913, making a net increase of 240. Of the total gas explosion fatalities, 261 were due to four serious explosions. There were slight increases in accidents due to explosions and electricity. There was also a net increase of 26 fatalities in shaft accidents, or 42 per cent., while on the surface, the net increase was five or about 3 per cent. The net decrease for the year for both underground and surface accidents at coal mines, as compared with 1913 was 12 per cent.

The exact figures for the number of men employed are not yet available, but taking the estimates as furnished by the inspectors for several of the States and using the same number of men as employed in 1913 for the other States, gives an estimated total number of employees for the year as 742,868 as compared with 747,644 in 1913. The fatality rate therefore becomes 3.30 per 1,000 men employed in 1914 as compared with 3.73 in 1913.

Excluding 1912, when the rate was 3.27 per 1,000 men employed, the 1914 rate of 3.30 per 1,000 is lower than any year since 1903.

While there was a reduction of 12 per cent. in the number of fatalities, there was also a reduction of 10.5 per cent. in the production of coal. The United States Geological Survey estimates the production for 1914 as 510,000,000 short tons, as compared with 570,048.125 tons for 1913. The fatality rate per 1,000,000 tons of coal produced in 1913 was 4.89 and in 1914 4.81. With the exception of 1912, when this rate was 4.41, the 1914 rate is the lowest yet recorded for the United States. The amount of coal produced per fatality in 1914 was 208,078 short tons, which with the exception of 1912 is the largest on record. The production per fatality in 1913 was 204,685 tons; 1912, 226,469; and in 1907, 144,325 tons.

There were 316 lives lost in disasters in which more than five men were killed at one time, as compared with 464 in 1913, a net reduction of 148, or 32 per cent. in this class of accidents.

It is not possible to attribute these lower rates to any one particular influence. They may, however, be assigned in any part to any one of the following agencies or to a combination of all of them; closer and more careful inspection by the State inspectors; better enforcement of laws and regulations by the operators; a realization of the dangers attendant upon the miner in his daily work and his efforts to reduce accidents due to the educational campaign conducted in his behalf; the extended use of safety lamps in doubtful mines; the use of permissible explosives; humidifying dusty mines; first aid and rescue training which saves lives that might otherwise be lost by reason of injuries received; the enactment of industrial accident compensation laws; and last but not least the spirit of co-operation on the part of all concerned.

BRITANNIA MINING AND SMELTING CO., LIMITED

The Britannia Mining and Smelting Co. is operating a large copper property situated in Vancouver mining division, British Columbia. An account of this property, written in 1913 by Mr. R. G. McConnell, then on the field staff of the Geological Survey of Canada, was printed and issued as an appendix to the International Geological Congress Guide Book No. 8, published by the Geological Survey, and reprinted in the Annual Report of the Minister of Mines for British Columbia, 1913. Those interested in the description of the rocks and minerals occurring here can find the particulars given by Mr. McConnell in either of the publications mentioned. The general information follows:

Mr. McConnell wrote: "The group of mineral claims owned by the Britannia Mining and Smelting Co., and known as the Britannia mine, is situated in the Coast range east of Howe sound, about 20 miles directly north of the City of Vancouver, and 28 miles following the steamer route along the coast. Howe Sound is an irregular fiord, cutting well back into the Coast range, and is bordered along its whole length by rugged mountains and high ridges. The claims now being worked are situated on a steep ridge, about 4,300 ft. in height, separating Britannia creek from Furry creek. The principal workings are in the north slope of the ridge at a distance of three and a quarter miles from the coast and at an elevation of 3,275 to 3,775 ft. above sea level."

Concerning the minerals occurring here Mr. McConnell said: "The metallic minerals in the Britannia orebodies consist of pyrite, chalcopyrite, considerable zinc blende in certain areas, and rarely some galena. Small quantities of black oxide of copper and bornite occur as alteration products, but are nowhere abundant. The gangue is principally the greenstone schists forming the country rock, more or less silicified. Small quartz veins, generally following closely the direction of the schistosity, but frequently cutting directly across it, are numerous. Calcite in very small quantities is occasionally present and some fluorspar has been found."

The development of the Fairview mine, which is the one now being worked, was thus briefly described: "The Fairview mineral zone has been opened by five levels at elevations of 1,050, 850, 700, 600 and 500 ft. below the summit of the ridge into which they are driven. The levels, with numerous crosscuts and raises following the orebodies, serve to explore the zone for a distance of 1,000 ft. along the strike and 500 ft. along the dip."

Of the treatment of ore, Mr. McConnell wrote: "The chalcopyrite in the Fairview orebodies occurs as a rule in fairly large aggregates, often separated by considerable waste, and the material mined is concentrated before shipment. The ore is crushed at the mine and transported to the mill at Britannia Beach by an aerial tramway built in two sections, with a daily capacity of about 600 tons. At the mill it is first washed in a 4x10 ft. trommel with 1½ in. perforations. The oversize discharges on to a sorting belt, and about 50 tons of 12 per cent. ore and 150 tons of waste are picked up daily from the 600 tons received. The milling ore, except the undersize from the washing trommel, passes from the conveyor to a Blake crusher, and then through a series of spring rolls, which reduce it gradually to the size required, about 2mm., for treatment in Hancock jigs. The greater part of the sulphides is separated out by these machines.

Part of Britannia Beach townsite, B.C.

"The tailing and the undersize from 1½-mm. trommels, are ground in Hardinge pebble mills to a 40-mesh or smaller size, and subjected to the Minerals Separation Co.'s flotation process, the details of which are kept secret. The Hancock jigs used are of the Anaconda type and the separation of the sulphides by them, followed by the use of the Minerals Separation process on the finer material, has given excellent results, only a very small percentage of the sulphides escaping. The concentration is in the ratio of 4 to 1."

Britannia Mining Co. Operations in 1914.

The approximate production and the gross metal contents of the ore for 1914, together with the corresponding figures for 1913 for purposes of comparison, are shown in the following table:

	1914.	1913.
Ore mined, tons	239,174	215,589
Ore milled, tons	240,272	215,121
Crude ore and concentrate shipped, tons ...	38,750	45,000

Gross contents—

	1914.	1913.
Gold, oz.	250	89
Silver, oz.	70,000	72,300
Copper, lb.	12,000,000	13,167,000

The demoralization of the copper market last summer resulted in a curtailment of production by about 50 per cent. as from the middle of August, also in a practical suspension of important construction work previously in progress.

Much underground development work was done in 1914, chiefly in drifting, crosscutting and raising.

The following is an outline of the progress made to the end of 1914 with the construction and other improvements the company is making with object of largely increasing its production of ore:

New Concentrating Mill.—The framing and roofing-in of the first 1,000-ton unit of the new concentrating mill, which is eventually to have a capacity of 2,000 tons a day, has been completed and the machinery (the larger part of which for the full plant is now on the ground) has been placed under cover. The grading and excavation for the second unit has also been completed. The storage and handling of the various products from the present 800-ton mill and the larger new mill have been greatly simplified by driving underneath the millsite a tunnel from which three 6x10-ft. raises have been made down which to pass the concentrates, etc. An electric railway is operated through this tunnel and connection with the new bunkers on the shipping dock is made over a trestle.

Transportation System.—The Britannia crosscut adit, which is the 2,200 ft. level of the mine, has been driven at an elevation that is 1,196 ft. below the lowest (1,050 ft. level) workings in the company's Fairview mine; its dimensions are 9x12 ft. in the clear, and it has been driven a total distance of 4,336 ft. from its portal. A 3 ft. gauge track, with 45-lb. steel, has been constructed the full length of the adit, which will in the near future be the main outlet from the mine. The three and a half mile aerial tramway which has for years been the chief means of transportation between Britannia Beach and the upper mine camp, will be used as an auxiliary system.

The working shaft that is being driven vertically from the 2,200 ft. level, starting at a distance of 3,922 ft. from the portal, to connect with the present productive workings above, has outside measurements of 10 x 20 ft. and is divided into three compartments, of which two for hoisting purposes are each 6 x 7 ft. 6 in. and one, a manway, is 3 x 7 ft. 6 in. This shaft is now within 217 ft. of being completed; in addition, much work has been done in cutting stations at intermediate levels, and in crosscutting to connect with a rock-raise also put up from the 2,200 ft. level. The latter, which will be the chute and storage bin for the ore, is 8 x 12 ft. and 1,268 ft. in length; it was holed through to the 1,050 ft. level on October 24, when work in it was stopped pending completion of the main working shaft, after which installation of the machinery, already received, will be proceeded with. This plant includes a 20,000 lb. double-drum electric hoist, to be placed on the 1,050 ft. level for operation of cages, etc., in the shaft, and a Gates crusher, to be installed in the rock-raise at a height of 400 ft. above the 2,200 ft. level.

From the mouth of the tunnel outlet from the mine, which is 2,100 ft. above sea-level, the ore will be hauled by electric locomotives over three and a half miles of sidehill railway, having a maximum grade of 3 per cent. and leading to the head of an incline the elevation of which is 1,600 ft. During 1914 the grading and track-laying on the railway was practically completed, and the incline, which connects the railway with the mill bins at Britannia Beach, was graded through with the exception of a cut at the upper end. This incline, 5,500 ft. in length and of an average grade of approximately 30 per cent., will be standard-gauge and double-tracked with 56-lb. rails; it will be operated by a winding engine, and 20-ton skips which will convey the ore from the bins at its head to the concentrators at the Beach.

Shipping dock and old concentrating plant, Britannia Beach, B.C.

Power.—As the first step toward the provision of additional power for the larger operations, the company is supplementing its present 500-kw. auxiliary steam turbine with a 2,000-kw. unit of the Fraser & Chalmers type, the arrival of which at the Beach has been delayed until spring. Meantime, the remainder of the installation, consisting of two 500 h.p. Babcock & Wilcox high-pressure steam boilers, was completed in December, necessary arrangements having been made in the way of stack and breeching for the addition of a third similar boiler at an early date.

During last summer the company greatly increased the capacity of its Utopia storage dam at the head of Britannia creek, to which recourse is had for supplying the Tunnel and Beach hydro-electric plants during periods of shortage of water from ordinary sources of supply.

Other improvements.—Among the numerous other improvements made during the year are the undermentioned: There were constructed new concrete tanks for

slimes and Hancock jig and Minerals Separation flotation process concentrates from the old mill; addition to the old mill plant of Hardinge pebble mills, Allis-Chalmers tube mill, Butchart tables, slime pump, water-wheels, and other new equipment; more buildings were erected, including eleven dwellings for employees, some with five and others with four rooms; a large bunk-house was built at the Beach; all buildings on the property were painted; an up-to-date laundry, electrically operated, was completed, this to be run in connection with the Britannia stores; a new wagon bridge was

Aerial Tramway, Britannia Beach, B.C.

constructed over Britannia creek; provision was made for recreation and amusement of employees by adapting a large building for use as a roller skating rink and dance hall; modern fire-fighting apparatus was put in, and three pulmotors (for automatic resuscitation with oxygen) were purchased and men instructed in their use; and generally much else was done for the more efficient operation of the mine and concentrating mills and the accommodation and comfort of the company's many employees.

QUEBEC BUILDING AND ORNAMENTAL STONES

The third volume of a report on the building and ornamental stones by Dr. W. A. Parks has just been published. Volume I contains two parts, the first consisting of a general introduction to the subject and the second dealing with the building and ornamental stones of Ontario. The second volume contains a systematic description of the stones of the Maritime Provinces, and the present volume is devoted, in like manner, to a description of the building and ornamental stones of the Province of Quebec.

The Province of Quebec produces limestone of structural quality in large amount; it is rich in deposits of granite of various kinds; it is rapidly assuming a position of importance as a producer of marble, and it possesses the only important slate quarries in the Dominion. Sandstone is quarried in small amount and possibilities exist for the production of many of the rarer decorative substances.

Limestone of excellent quality is obtained on Montreal island, on Isle Jesus, and at various points north of the St. Lawrence river; it is largely quarried at Hull and at points in the Eastern Townships, such as St. Johns and St. Dominique.

Important granite quarries are located at Stanstead, in the little Megantic mountains, and at other points in the Eastern Townships. North of the St. Lawrence, producing quarries are found in Argenteuil and Ottawa counties, and to the nortward of the city of Quebec at Riviere a Pierre and Roberval. Dark basic rocks commonly called "black granites" are quarried at Mount Johnson, and opportunities for the production of this class of stone are afforded by many other localities.

Decorative and structural marbles are quarried on an extensive scale at Phillipsburg, in Missisquoi county, and in the township of South Stukely. The crystalline limestones of the great Pre-Cambrian area north of the St. Lawrence present many possibilities for the production of marble. A company has recently worked at Ste. Thecle, in Champlain county, and extensive operations are being planned for quarrying the white stone at Portage du Fort, in Pontiac county.

The production of sandstone is small and is practically limited at the present time to the hard whitish stone at Beauharnois. The Sillery sandstone near Quebec is still used in small amount, and a small quarry is operating in beds of Carboniferous sandstone on the north side of the Restigouche river. The Devonian sandstones of Gaspe present great possibilities, but they are not now being exploited.

Extensive deposits of serpentine are found in the Eastern Townships, and in the county of Grenville, but they have never produced decorative stone on a commercial scale and are not being worked at the present time.

Slate is quarried in the township of Melbourne and at Long Lake, in Temiscouata county. Many other slate belts are known, the commercial possibilities of which have never been thoroughly investigated.

The rarer decorative substances, particularly garnet-bearing rock, varieties of porphyry, and the iridescent feldspars, are known to occur in the province, and may prove a source of future supply.

Dr. Parks discusses the occurrence and properties of the several classes of stone in a very interesting manner. The report is splendidly illustrated with half tones, maps and colored plates.

MICHIGAN COPPER MINES BUSY AGAIN.

Houghton.—Every mine in the Lake Superior copper mining district, that is, every copper producing mine, is again working full time. The net increase in the output of refined mineral from this district is likely to show over 2,000,000 lb. in February and 2,500,000 in March. This additional copper will not of course reach the market before April, and will not have any appreciable effect on the market supply until late spring, if then.

Calumet and Hecla and its subsidiaries were the last mines to return to normal working time, following the slump at the beginning of the European war. Wolverine and Mohawk kept up full time all through the slump. Baltic, Champion and Tri-mountain went on half time, and just a few weeks ago resumed full time. Quincy has been working full time, but operating three shafts only. Other smaller mines worked full time.

DEPARTMENT OF MINES PUBLICATIONS.

The Department of Mines has published a new edition of "Economic Minerals, and Mining Industries of Canada" for the Panama-Pacific Exposition.

THE EVOLUTION OF STOPING METHODS DURING THE LAST DECADE*

By C. A. Macaulay.

In very sound rock, excavations of considerable size may be made without the necessity of immediately supporting the walls and roof; but even in such cases unprotected ground usually becomes dangerous in the course of time. In the case of weaker or more shattered rock supports are required for the roof and often also for the walls at an early stage in the excavation.

Drifts and shafts, being narrow work, naturally stand better than larger openings, but even they are usually protected—except in very sound rock—as their integrity is essential to the operations of mining. Shafts in particular are almost always substantially timbered or walled, not only for safety but also to carry the hoisting guides, ladders, etc.

Stopes are on the other hand, more or less temporary in their character, and when small they can often be excavated with little or no support. Large stopes almost always require protection of some sort or other, and it is proposed in this paper to discuss the methods most commonly in use for this purpose. The discussion will, however, be limited to workings in metalliferous ore bodies, and even iron ores will be included only incidentally. It should also be noted that the discussions will not include the modern caving methods such as top slicing, as these methods are radically different from ordinary stoping.

The methods of supporting the walls and, when necessary, the working face of stopes may be grouped under six general heads:—

(1) By timbering with setts.
(2) " filling with waste.
(3) " leaving pillars or ribs of ore.
(4) " filling with broken ore over dry walls.
(5) " the underground drifts method.
(6) " caving in descending slices.

The suitability of any one of these general methods for working any particular deposit, still more its detailed development, is dependent on a number of factors, of which the most important are: (a) The form of the deposit, (b) Its size and particularly the width, (c) The dip, (d) The character of the walls, (e) The character of the ore, (f) The extent to which the ore or the walls have been shattered by movements; penetrated by dykes, etc., and (g) The cost of labor and materials, and the grade of the ore, etc. This last consideration may almost be said to govern all the rest.

Many systems from a scientific point of view are very interesting to work out and scheme applications for; but in doing so one must not lose sight of the big factor, namely, costs. Of course, any methods or combinations of methods, no matter how suitably they may be applied to the problem in hand, can only be of passing interest to the operator, unless they show in addition to everything else a favorable cost sheet.

Timbering.—Some years ago sett timbering was almost the universal method of supporting stope excavation. Gradually other methods have crept in, replacing it, so that to-day, in a large majority of districts, framed timbering in stopes is a thing of the past.

We must not, however, in our rush to bring forward better and cheaper methods of stope support, lose sight of the fact that stoping with square setts has been very successful. There are some very important districts even now that still adhere to the method. For instance in the district around Buttte, Mont., where the ores are rich, relatively soft and the walls much shattered they know almost nothing else in actual practice. Butte trained men are very skeptical of other methods and often afraid to work under large backs without the immediate protection of timber. In other districts setts have been given up for the main stope; but are still used as a secondary device; that is, they are employed in small portions of a mine or stope where the ore is too soft and friable to permit of being removed without an immediate cover. In many of these cases, and in others which need not be named we must not condemn this use of timber because it really is an admirably convenient and safe method, and often justifies its cost.

In many places, however, timber setts are still used without any real reason except that the camps are in charge of miners of the old school, non-technical men who are, as a rule, very conservative when it comes to trying new schemes and methods. Such men are often excellent miners, but they allow themselves to be prejudiced in favor of older and more familiar customs. In general, however, stoping with timber should give place to later methods, not for one, but for a combination of many reasons, the chief of these being in most districts the increasing and often prohibitive price of timber. Then there is the danger of creep and crush, and in after years of subsidence. Added to all this there is the risk of fires. If we look back at the records of such mines as the Comstock or Broken Hill, or even Calumet and Hecla, we will see that crushes and fires have cost more than enough to have paid for filling systems many times over.

Filling with waste.—This method, which originated abroad even before we first used timber setts, is of comparatively recent use in this country, so far at least as it concerns replacing timber in stopes. The system necessarily calls for a large amount of waste rock, and although a certain amount of waste is ordinarily made in cutting the stopes themselves, there is never enough to fill the stope. Resort is made usually to waste rock from development work and to rock house waste, mill tailings, etc. The latter, in conjunction with dry walls of rock or waste, is largely used, since it is easily available and may be cheaply handled. It is quite common in Australia, where the tailings are dried out thoroughly, so as to free them as far as possible from cyanide of potassium, and are then sent into the mine. In South Africa, on the Rand, enormous quantities of tailings are now chemically treated to destroy the cyanide and are sluiced into the stopes, the water being drained off and pumped to the surface leaving the tailings in a compact mass.

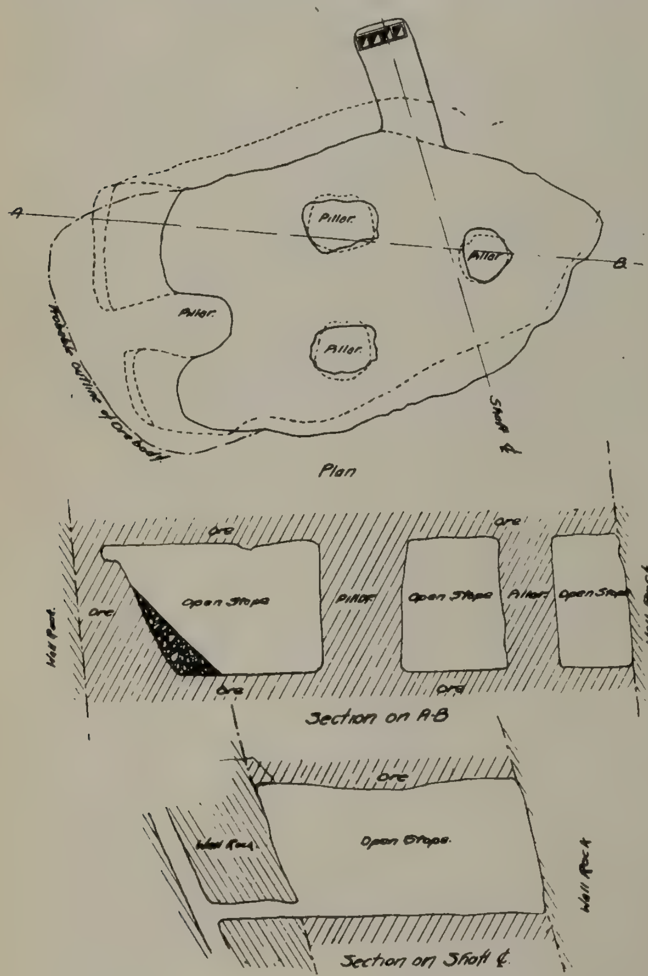
In cases where neither of these residues can be obtained for filling, inclined raises are sometimes driven into the walls and small amounts stoped from the wall rock to answer the purpose. This form of filling is

*A paper read before the Mining Section, Canadian Society of Civil Engineers, January 14, 1915.

somewhat more expensive, but raises may be driven in such a way that the fill is placed by gravity; as an example of this we have the Tramway Mine, Butte, Montana.

The main feature which requires care in this system is that winzes must be kept open. To work to the best advantage the winzes through the block of ore under attack should be kept in alignment with similar winzes from above, so that filling may be sent down from the surface or from any intermediate level. The logical place for these winzes is in the hanging wall of the stope as the waste will then reach the foot wall of the stope with a minimum of handling.

The disadvantage of this system is that a certain amount of timber must be used for chutes and in the dry-walls as binding matter. The building of dry walls for the tramways and the placing of timber



Plan and Sections Showing Method of Support by Pillars of Ore

and lagging required to cover them is a heavy expense, as is the first cost of timber necessary.

As an example of this type of mining we may look at the South Range Mines, Houghton County, Mich., such as the Baltic, Altantic and Champion mines and many others. In these mines the filling is kept just high enough for the machines to back stope from the fill floor. In most cases where the ore requires support, a few short stulls set on the fill are sufficient to hold the back; these are usually recovered when the next cut is taken down. When stulls are not heavy enough cribs or bulkheads are used. They are filled with waste and usually lost by being buried. Compared with all timber methods, such as square setts, the filling method has the advantage of more effective support to the mine, less danger of creep and much less danger of fire, and in most cases is by far the cheaper of the two.

It is stated that the cost of timbering by square setts in the LeRoi Mine is 21c. per ton of ore excavated. In the Ivanhoe Mine, West Australia, the cost of filling the stopes with waste is 22c. per ton of ore excavated. At the Le Roi, timber is said to be worth $10 per "M." At the Ivanhoe, it is worth $50 per "M", so that setting there would cost about 65c. per ton of ore excavated. From this we see that the location of the mine as affecting the cost of essential supplies is one of the big factors that has to do with selecting a method.

Pillars of Ore—As a method of supporting stopes in the type of mine under consideration, the use of ore pillars alone, strictly speaking, has no place. This method can be used only in mines where the walls are exceptionally strong, and where the backs show no tendency to cave at all.

Ore bodies of this character are rare, and even when they occur this method is only applicable to a moderate depth, as no ore pillar of reasonable size will stand the great pressures that are unavoidable at great depths. Another objection to this method is that a large amount of ore is locked up in the pillars, and only part of it can usually be recovered when the stopes are abandoned.

In shallow mines, however, the method works very well indeed. Pillars carry the back in a series of very high arches, and the ore is taken out by breast and bench stoping, a back of about 30 ft. being left to be broken down from the level above when the stope below has been worked out. This system has been largely used in the upper levels of the mines of the Sudbury Nickel District, and in some of the mines of the Tennessee Copper Company as well as elsewhere.

The disadvantages of this system in addition to the loss of ore in pillars are: the heavy expense of scaling necessary to keep the backs free from loose ground which would be liable to fall and thus endanger the miners below, and the expense of mucking, since all muck must be shoveled from the sill floor into cars for tramming. These disadvantages, however, are more or less completely offset by not requiring filling at all. So this system, if it may be so called, is excellent in so far as it goes; but its use is extremely limited. Ore pillars are often used in conjunction with other methods, but that will be discussed elsewhere.

Broken Ore Filling Over Dry Walls.—This method of support is generally known as "Shrinkage Stoping." It entails the construction of dry walls and ore-chutes, as in the filling with waste method; but it disposes with the winzes necessary for that method, and makes it possible to place nearly all of the filling by gravity.

The method is to stope out the sill floor and then to dry-wall along one or both sides of the proposed tram using ore with a timber binding and a timber lagging overhead; then to back stope the broken ore, filling the stope between and over the haulage ways. Chutes must be built up to keep pace with the filling, and as the broken ore occupies from 30 to 45 per cent. more space than the ore in place, the surplus ore must be drawn off. This is done continually through the chutes as the stope is broken towards the level above. The remaining 55 to 70 per cent. is left in the stope, affording a temporary support to the walls and a working floor to the miners. When the stope is com-

pletely broken through to the level above, it will be full of broken ore which may then be entirely drawn off. The dry-wall of the level above will come down with this also, as the last work in the stope will be the shooting out of the floor pillar between the working stope and the one above.

A stope that is to be mined by this method requires only by way of development, besides the haulage entry joining it to the shaft, to have preliminary winzes or raises at its extremities to provide a means of ventilation and an alternative method of entrance and exit.

When all of the broken ore in a worked out stope has been drawn off, the walls in most instances may be allowed to cave in. In cases where this is dangerous, or not convenient for any reason, some means of support must be afforded them such as rib pillars left in place, or waste filling which may be drawn down as the workings go deeper.

The advantages of this method are that practically no shoveling is necessary in the stopes, since the ore will come around the chutes, and when the angle of rest is exceeded, will roll into them. A greater distance between levels is possible than in the earlier method, and fewer raises and winzes are required. The cost of filling the stope is practically nothing since the ore has to be broken anyway.

The system has its disadvantages, however, the chief of these being that the ore must be broken fine enough in the stopes to prevent blocking in the chutes. It is not always possible to prevent some large pieces getting into the chutes and a little trouble is usually experienced from this, but the same may be said of the waste fill method in this respect. Then the breaking for some time of more than double the tonnage that the mine can ship results in the locking up of a considerable sum of money. In the long run, however, as the mine opens up new stopes and finishes old ones, this difficulty disappears. It also ensures a steady output.

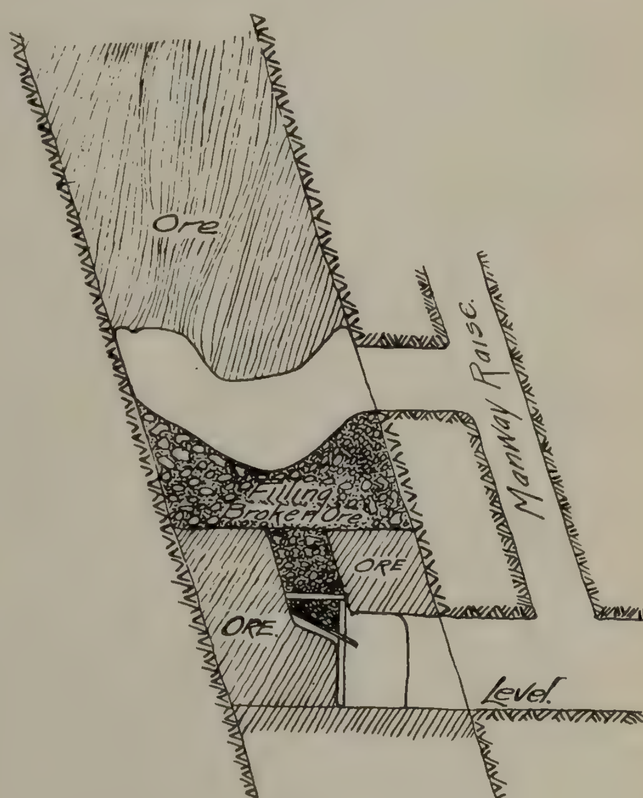
As typical examples of this method we have the King mine, the Coronado mine and others in Graham County, Arizona. There are also numerous mines in Canada where the method is carried out in its main features.

The Under-Drift Method.—We now come to a consideration of the last and most recent of the methods involving filling as distinguished from caving, namely, the under-drift method. By way of introduction we might say that this method, although it has been very successful in so far as it has been used, has not as yet really had sufficient application to varied problems to justify one in calling it a standard method. However, in as much as we believe that it will in the near future make good and become a standard method, we shall speak of it from now on as already being such.

This method is probably one of the most simple and inexpensive systems for filling that has as yet been developed. The salient and new feature of this method is that it does away with timber practically entirely in the stope, and instead uses the ore or rock in place. In the method last discussed, we do away with, excepting the small amount used for binding the chutes, the timber while raising the stope from one level to the other, but we do not eliminate it on the sill floor in which place a considerable amount must be used. In the under-drift method we eliminate the sill floor timber entirely, in the sense in which the term is ordinarily used, and place the haulage roads in the floor pillar instead of on top of the floor as is usual.

The main idea of this system is to eliminate the timber on the sill floor. The method of doing this is as follows: When laying out a level the first 15 to 20 ft. of the ore-body above the floor level is left in place, instead of being stoped out as is usual; this ultimately forming part of the floor pillar or back of the stope which in due course will be cut below. This flat pillar is necessarily left until such time as the stopes above and below are worked out and are ready to have their broken ore drawn off.

The drifts and crosscuts which are to serve for haulage ways for the stopes are driven in this floor pillar. From these haulage ways raises or box holes are driven vertically upward, or at an incline, to the level of the bottom of the proposed stope which as stated above is from 15 to 20 feet above the floor of the crosscut, These box holes are usually about 25 ft. apart and are placed alternately on opposite sides of the haulage ways and are provided with chute gates. The lay-out of the haulage ways depends on the size and shape of the ore-body. In most cases they would be planned



Section Showing Application of Under-Drift Method to Narrow Stopes

and spaced in the same way as the dry-walls roads for ordinary shrinkage stopes. Entrance for men to the stopes is secured by means of manways which are generally placed in the pillars; but in the case of a narrow ore-body they may be placed in the walls a few feet back from the contact. In both cases the manways are usually connected to the stope about every 25 ft. (vertically). The stope is then opened out to connect with the top of the box holes, and this broken ore, or rather the surplus, is drawn off through the box hole gates into mine cars run just under the lip of the gate and are loaded by gravity so that practically all shoveling is done away with.

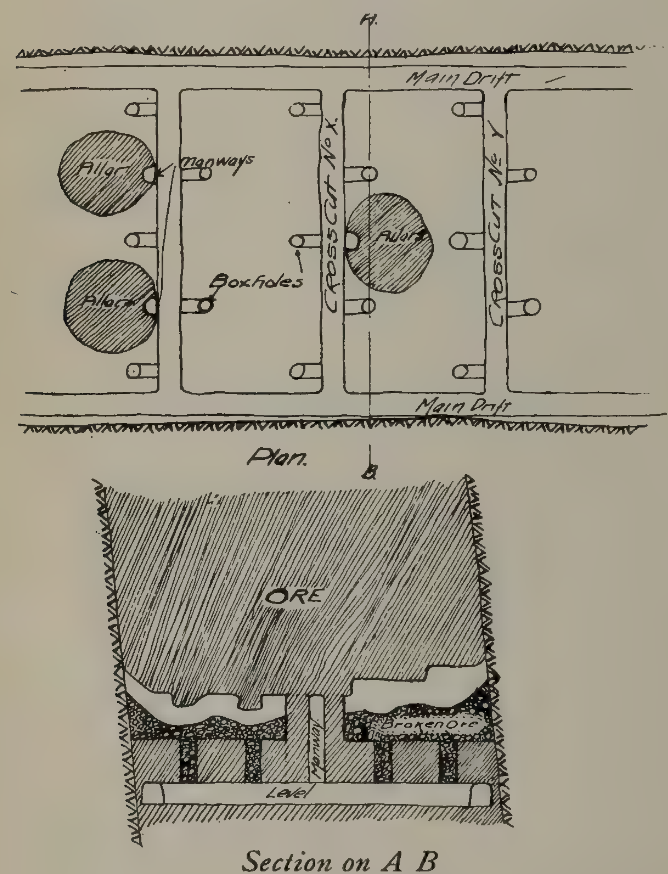
The actual stoping by this system, once the development is done, is the same as in any ordinary shrinkage stope. That is to say, back stoping proceeds in a series of rills, the broken ore supporting the walls and forming a working floor. A unique feature of this system is that the pillars, as they have raises in them serving as manways, may be drilled out as the work is driven up, the holes being plugged, and when the stope is worked out they may be shattered by blasting, and largely, if not totally, recovered. In the case of rib pillars the recovery would be less complete unless there were two or three raises; but even with a single raise a large part of the rib should be saved for, where the ground is weak enough to require rib pillars, it would probably be weak enough to break pretty completely when partly shattered and the support removed.

Taking everything into consideration we can see that this system has many advantages over the older practices. By far the most important of these is the elimination of the use of timber. Then, again, shoveling, which is always costly, is reduced more nearly than ever to a minimum. Also, there is practically no chance of a heavy crush ever closing up the haulage ways or the entrances to the stopes.

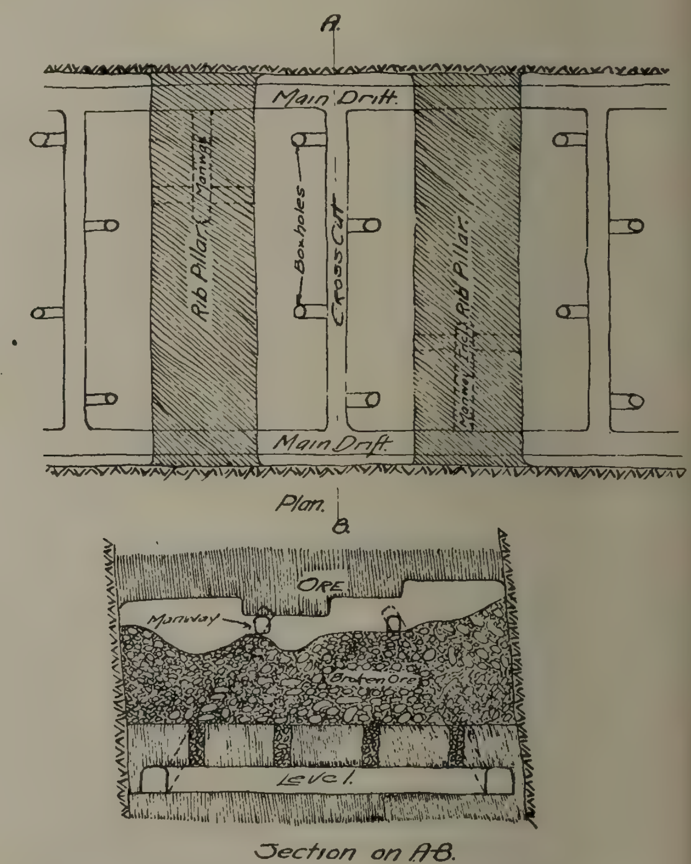
The development of a stope by this system probably requires more time than by the others if we count merely to the beginning of actual stoping operations, but when a stope is once started by this system the work should proceed without any subsequent check, whereas in the dry-wall system, for instance, although the sill floor is opened out more promptly, there is always a considerable delay while the dry-walls are being built and the chutes built in, and stoping proper cannot begin until this work is finished. On the whole, therefore, the system has all the advantages which ordinary shrinkage stoping possesses over dry-wall, with the added advantages that accrue from having no timber in the stopes.

An excellent example of this method of stoping is to be seen at the Dome mine, South Porcupine, Ont. It is also successfully used at the Frood mine, near Sudbury, Ont.

Caving.—As stated in the introductory paragraphs this system will not be considered here, as it is not strictly a stoping method, and is in general rarely suitable for as hard ores as those which have been considered above. Caving systems are, however, exceedingly cheap and satisfactory where practicable, and are very largely used not only in the soft iron ores on which they were first developed, but also in a number of the large, soft and medium copper ores in the south-western parts of the United States.



Plan and Section Showing Application of Under-Drift Method to Wide Ore Bodies



Plan and Section Showing Application of Under-Drift Method to Stopes with Rib Pillars

Comparison of the Various Systems.—In comparing the various systems of stope support that have been considered in this discussion we must remember that no two ore bodies are exactly alike in size, shape, character of walls and a dozen other features, and that, as mining is a matter of good practical engineering rather than pure science, there are therefore almost as many detailed methods of mining as there are miners. In view of this we must exclude all minor details from consideration, and we must draw out comparisons in as general a way as possible.

The rapid disappearance of the virgin forests of this continent, and the consequent advance in prices of timber has already greatly affected the mining industry, and the further inevitable rise in prices will

soon make "mining without timber" an essential feature of the economic operation of low-grade deposits.

It is probable that this matter of timber engrosses the attention of the most up-to-date mining operators more than any other single factor in their profession at the present time, and any system that can effect an economy in the use of timber, without loss of efficiency in other ways, must either now or in the comparatively near future, be given preference over the older systems that are so extravagant in their use of this once over-abundant material. In reality the whole question is one of dollars and cents; the systems that can give the greatest ultimate realization of profits are naturally the systems that will be used.

Greater temporary profits are often to be had from a wasteful or extravagant method; but they often mean lesser ultimate profits for the whole property owing to loss of ore, etc. Again, a given system, as applied to a particular mine may be very cheap to operate, but dangerous, and the cost of resulting accidents may greatly overbalance temporary gains. These are problems, however, which can only be solved by a thorough study of the individual property which one desires to develop and no more need be said of them here.

If we now compare, in a general way, the timbering and the shrinkage methods or waste filling methods, we can see that where the walls and ore are reasonably strong to resist caving, the latter methods have a decided advantage over the former in that they require so much less timber, and are practically on an equal with it in all other respects.

As to the ore pillar system, we can hardly compare it to the other systems since it requires such exceptional strength of walls and ore that it can never come int very general use.

Continuing our comparison, it is also obvious that the under-drift method is as far in advance of the shrinkage and waste filling methods as they are ahead of timbering methods, since it requires no timber at all.

The nearest approach to the under-drift method as described here that I know of in mining literature is that of the Alaska Treadwell mine, Douglas Island, Alaska. This system is very similar to the under-drift, in a general way, although it varies very considerably in detail. In comparison, we have the system that is in use at the Homestake mine, Black Hills, South Dakota. There they have done away practically altogether with timber; but without substituting the under-drift feature. Consequently they have to shovel all muck from the floor into cars. This, of course, would seem unnecessary and very undesirable.

In addition to the above consideration the elimination of timber in the mine is a big factor in preventing fires underground. Such fires have in the past proved very disastrous, but in a mine with up-to-date equipment such as reinforced concrete shaft walling and ore pockets, etc., and with steel or reinforced concrete wherever support is necessary, and virtually no timber in the stopes, there is practically no chance of fire.

Conclusion—In conclusion one may say that although Europe has for some years been forced to economize in the use of timber, we of America have not as yet seriously felt the shortage of timber supply. But that it is bound to come is a fact that cannot be questioned. Consequently it is, in the future to the timberless systems of mining that we must look as a means of recovery for low-grade ore bodies.

In conclusion the writer begs to acknowledge the assistance of Brinsmade's valuable book on "Mining Without Timber" for descriptions of the Homestake and Alaska Treadwell mines which he has not seen. He is also indebted to "Hoover's Principles of Mining" for certain ideas in his sketches and for some valuable ideas. This paper is, however, in most respects the outcome of several years personal experience of actual mining work, chiefly in central and northern Ontario.

TEXADA ISLAND, B.C.

The Geological Survey has just issued a report by Mr. R. G. McConnell on the geology and mineral and other resources of Texada Island, B.C.

The principal industries of the island are mining, lumbering and agriculture. Of these, mining at present is much the most important.

The mineral deposits of the island include important gold-copper sulphide ore bodies, numerous large masses of magnetic iron ore, and quartz veins carrying free gold. The copper deposits so far have yielded the best returns.

The Marble Bay mine, which has been continuously worked for over 14 years, and has now reached a depth of over 1,000 ft., produces about 1,200 tons a month, much of it high grade ore. The Cornell and Copper Queen have been worked by leaseholders and production has been intermittent. The known lenses have been practically exhausted, but the conditions at both mines warrant further explorations. Small shipments of copper ore have also been made from the Little Billy, Loyal Lease and from the Iron Range on the west coast.

The magnetite deposits are not being worked at present, but will probably play an important part in the future history of the island. The magnetite occurs in lenses varying in size from small bunches up to great masses several hundred feet across. The ore is high grade, the iron contents usually exceeding 60 per cent., but is seldom free from iron and copper sulphides, and much of it will require roasting before treatment. Shipments of iron ore from the iron range on the west coast were made regularly for some years to the Irondale smelter, Washington, and the product shipped to San Francisco. On the east coast a considerable quantity has been mined and used as a flux at the Vananda smelter.

Gold quartz veins are numerous, especially on the northern end of the island, and have led to a number of excitements. The veins are mostly small, and the gold contents have proved to be exceedingly pockety. Work on them is now practically abandoned.

In addition to the metallic minerals, the limestones, marbles, clays and sands of Texada island are important. The limestones at the northern end of the island, a bluish compact variety, are very pure and furnish an excellent lime. The supply is practically unlimited, and six kilns with a capacity of about 600 barrels a day have already been built. White, greyish and reddish marbleized limestone occur on various parts of the island, and marble quarries have been opened up on Sturt and Anderson bays. Work on both of these has been suspended for some years. The crystalline limestones, while usually strongly jointed and fissured on the surface, include small areas which judging from the surface exposures, are free or nearly so from these partings, and it is probable that a careful search for marble of a marketable quality would be rewarded with success. Clays and sands of glacial age occur at various points on the west coast, but so far have not been utilized or tested as to quality. A red clay bed at the base of the Cretaceous, evidently a residual deposit from the waste of the porphyrites in Pre-Cretaceous time, may possibly have some economic value.

ARISAIG-ANTIGONISH DISTRICT NOVA SCOTIA

The Geological Survey has published a memoir, No. 60, by M. Y. Williams, on the geology of a district in Nova Scotia, which is regarded as a key area for the stratigraphy of a considerable region.

The area has already been studied by many geologists.

The purposes in further examining the district and making the present report, were mainly two-fold, first, to work out in greater detail than had hitherto been done, the stratigraphic relations of the sedimentary formations to one another and by means of such relations and from palaeontologic evidence to determine more closely the age of the sediments; and second, to classify and work out the relations and ages of the intrusive and extrusive igneous rocks of the district.

The Arisaig-Antigonish district fronts on Northumberland strait and it situated about one-third of the way from Cape Breton to Pictou harbor. The area studied includes 10 miles of coast line, with Arisaig point at its centre, and extends inland southeast about 11½ miles to the Intercolonial Railway, including also the gypsum deposits south of that railway. The approximate area of the district is 115 square miles.

In many places green copper stains occur in the Mississippian formations in connection with plant remains, and some serious prospecting for copper has been done near Brierly brook. Ore is said to have been taken from one of the shafts sunk here, but only green stain of copper could be observed on the dump. So far as present indications go, there is no hope of finding workable deposits of copper in the Arisaig-Antigonish district.

An iron ore bed over 2 ft. thick on an average occurs in the Silurian strata south of Arisaig. It contains many distinctive fossils and is loose and friable at the surface, but when fresh is firm and finely oolitic. The attitude of the strata is nearly vertical. Some ore has been removed from this bed, but the prospects are now abandoned, presumably because of the low grade of the ore. The bed is in a badly faulted zone and could not be depended upon to continue unbroken for any great distance.

Near Browns Mountain post-office and in the locality of Doctors brook, oolitic hematite is apparently interbedded with the greywacke of the lower formation of the Browns mountain rocks. In the former locality the ore "beds," which are two or more in number, vary from about 5 to 20 ft. or more in thickness. The ore is evidently very siliceous. A part of the thicker "bed" is merely a grit impregnated with iron.

The ore "beds" of Doctors brook vicinity are three in number and vary from 2 to 8 ft. in average thickness. The thickest "bed" is very siliceous, but the thinner "beds" are freely oolitic, sparingly fossiliferous, and contain a fair percentage of iron (40-48 per cent). The iron ore horizon is found near the base of the upper formation of the Browns mountain group, which occupies a narrow belt to the south of the ore zone. The iron ore "leads" have been traced for about 3 miles, the ore "beds" being nearly vertical all the way. Numerous small faults intercept the ore and its thickness is variable.

From the evidence obtained, the ore is most probably sedimentary, is of lower Ordovician age, and may be directly correlated with the bedded hematites of Great Belle isle, Conception bay, Newfoundland. Small faults have been demonstrated as cutting the ore, but there appears to be no evidence of either extensive faulting or dislocation due to igneous intrusion between the East branch of Doctors brook and the west brook flowing out of the Little hollow. The ore beds are on the north side of a syncline and probably extend downwards without any serious change in attitude for several hundred feet. The faulting of the region appears to be mainly vertical, so horizontal displacements are not thought probable, but may exist. Much ore is already in sight and the main consideration is one of the grade of the ore, and expense in mining and transportation.

Oil shale has been discovered within the district in the vicinity of Pleasant valley and Maryvale. It is interbedded with the lower strata of the McAras brook formation. As the formation containing the shale lies at a low angle, the oil shale beds should not be buried to great depths. However, the thicker upper beds of shale found at Big marsh lie immediately below the basal limestone of the Ardness formation and probably have been removed entirely from the region about Pleasant valley and other localities in this district.

According to the breadth of karst, or sink-hole, topography and the general dip of the formation, the gypsum beds in the vicinity of Brierly Brook station are estimated to measure about 200 ft. in thickness. The gypsum stands as exposed cliffs 30 to 40 ft. high for more than one mile along the Intercolonial Railway near Brierly brook, and at other places similar exposures occur. The deposits are for the most part little mixed with foreign matter. However, water action has honeycombed the surface and doubtless much sand and gravel have fallen into the openings. Large quantities of gypsum are situated close to the railway inviting exploitation, and as soon as there is a sufficient demand for this material these deposits will be extensively worked.

Old lime kilns and lime quarries exist at a number of places along the limestone horizon north of the Intercolonial Railway. The quality of the lime formerly burned here is said to have been good. The workable limestone is probably not more than 20 feet thick, but the strata dip at low angles and much stone could be taken out by following along the strike of the bed.

Water worn gravel suitable for road metal and concrete work may be obtained from accumulations in the beds of the streams.

Although silver has been prospected for, none of any account has been obtained, and there are no indications of the presence of silver ores in the district.

Veins of calcite or quartz are not common and the chances are small for finding workable ores of any of the finer metals.

METALLURGICAL SMOKE

With the idea of bringing about a better understanding between the metallurgical industry and agriculture as to the troublesome smoke problem at smelting and ore-roasting plants, the United States Bureau of Mines has just issued Bulletin 84, "Metallurgical Smoke," by Charles H. Fulton, consulting metallurgist.

Metallurgical smoke causes considerable friction between the metallurgical industry and agriculture in certain districts. Owners of smelting plants are making every effort to devise ways and means to do away with possible damage and annoyance from smoke and are meeting with success. The problem is peculiarly difficult in the United States because of the large tonnages of material that must be handled. The solution

of the problem is not yet at hand and much work still remains to be done. As the mineral industry is one of the great basic industries of the country and of necessity is entitled to full consideration, it should be accorded freedom to work out the smoke problem to the benefit of all concerned. The effort is made in this paper to present the problem of metallurgical smoke as it actually exists, without bias of any kind.

The author says, "Sometimes, in discussions of the smelter-smoke question by interested parties, gross misstatements of fact are made. Thus, the agriculturist sees bad effects from smelter smoke which other people cannot find, and the metallurgist sometimes goes so far as to claim that smelter smoke is beneficial to vegetation, and even to assume that the damaging constituent of smelter smoke is sulphur trioxide only, giving rise to sulphuric acid, and to ignore entirely the sulphur dioxide content. It is evident that nothing is to be gained by a policy of this kind, and the solution of the problem lies in its study by disinterested commissions, such as the one recently appointed by an agreement between the Department of Justice and the attorneys of the Anaconda company to study the smoke question in Montana in its relation to the forest reserves.

"It is interesting to review the general situation in the United States. Much of the trouble is in the Western States, and chiefly in Montana, Utah and California. In those States very large tonnages of sulphide ores are smelted with the production of great volumes of smelter smoke, comparatively rich in sulphur dioxide and other injurious constituents. A number of the smelters have been in operation for many years and have experienced difficulties only comparatively recently.

"It is well known that mining and metallurgy are often the advance agents of civilization and the pioneers in establishing industrial centers. In many localities the mines and the smelters supplied by them were essentially the only locators within great stretches of territory. Around them grew communities and cities dependent upon them for a livelihood. Agriculture was of relatively small importance. But conditions changed with the increasing population of the country and the closer settlement of the West and coincident with this increase an agricultural industry has grown which, in the vicinity of the smelting plants, naturally suffers in some degree from smoke. Still, the area damaged is comparatively small and even this damage can be much lessened by the adoption of proper means. Since some plants have installed devices to remove sulphuric acid from the smelter smoke and have the smoke diluted with air, conditions have been much ameliorated in certain districts.

"The damage that smoke can do depends largely on climatic conditions, especially the relative humidity of the atmosphere. The damage is much greater in regions having a moist than in those having a dry climate. In this respect such States as Montana, Utah and Arizona are favorably located and smelters in those States can probably discharge gases richer in sulphur dioxide, without doing damage, than can those in regions having a moister climate. For the same reason, the damage done at different seasons of the year varies. The moist atmosphere and the rains of spring and early summer conduce to increased damage to vegetation, particularly as at that time of the year the early crops and young vegetation are susceptible to serious injury.

"It has been customary to discharge the smelter smoke by means of very tall chimneys, on the assumption that if the noxious gases are discharged at considerable height they will have opportunity to diffuse more thoroughly and thus become so diluted as to be comparatively harmless, but the efficiency of this method is now being questioned. There is reason to believe that the use of high stacks increases the area to damage, whereas low stacks may intensify the damage but concentrate it within a smaller area. Probably high chimneys do not serve their purpose as well as was anticipated, and at present the better method may be to dilute the smelter smoke and discharge it from a number of low stacks."

Copies of Bulletin 84 may be obtained by addressing the Director of the United States Bureau of Mines, Washington, D. C.

THE UNIVERSITY OF TORONTO AND THE WAR.

Though the military organizations of the Canadian Colleges were in a much more rudimentary condition than those of the British Universities, a large contribution has already been made to the army for the present war from their graduates and undergraduates.

The following is an account of what has been done by the University of Toronto:

First Contingent—Officers—Lt.-Col. C H. Mitchell, B.A.Sc., member of the Board of Governors; Lt.-Col. R. D. Rudolf, Professor of Therapeutics; Lt.-Col. W. A. Scott, Associate in Surgery; Major P. Goldsmith, Demonstrator in Oto-Laryngology; Captain G. R. Philp, Demonstrator in Anatomy; Captain P. K. Menzies, Assistant in Clinical Surgery; Captain G. A. Cline, Instructor in University Schools; Captain C. E. Cole, Demonstrator in Therapeutics; Dr. B. E. Clutterbuck, Assistant in Gynaecology; Dr. A. J. Mackenzie, Demonstrator in Medicine, and Mr. E. Owen, Lecturer in German.

According to our most recent information there are, besides the members of the staff, 134 graduates and 86 undergraduates, and of these 137 are officers and 83 privates. The chief electrician and several of the laboratory assistants are also on service, and their places are being kept for them. Professor de Champ, and Messrs. Balbaud and Bibet of the Department of French in University College have been serving with the French army since the beginning of the war.

Second Contingent—Officers—Lt.-Col. Fotheringham, Associate-Professor of Clinical Medicine, is Chief Medical Officer. Other members of the staff who have been giving their time in preparing for its mobilization are: Captain J. A. Amyot, Professor of Hygiene; Lt.-Col. J. A. Roberts, Demonstrator in Clinical Surgery; Lt. G. B. Strathy, Demonstrator in Clinical Medicine; Lieut. Bruce Robertson, Assistant in Pathology.

At present our information is quite incomplete, but we have the names of 53 graduates and 63 undergraduates who have been accepted for service in the second contingent.

At the opening of the session the Caput, Senate and the Faculty Councils passed regulations to provide that standing should be granted to those who by reason of enlisting had been unable to take their September supplementals; also, that those who had enlisted or who would do so, should be shown the utmost consideration at the end of the session that the University's duty to the public in maintaining professional standards will allow.

It was further decided to discontinue all teaching and laboratory work after four o'clock in the afternoon in order to enable students to take the courses of drill

and instruction required by the regulations of the Officers' Training Corps.

In view of the probable establishment of an Officers' Training Corps in the University, a score of junior members of the staff began about September 15th to take drill and instruction to qualify themselves to become officers in the new corps. About October 20th authorization was received from the Militia Department. Dr. W. R. Lang, Professor of Chemistry, who with the concurrence of the Board of Governors had volunteered for active service but was appointed instructor for this Military Division, was made Colonel of the new corps. Messrs. C. S. McVicar, A. D. Le Pan, G. N. Bramfitt, C. H. C. Wright, R. H. Hopkins, G. H. Needler, F. C. A. Jeanneret, L. Gilchrist, M. W. Wallace, G. O. Smith, C. N. Cochrane, C. V. Massey, G. M. Smith, E. J. Kylie, G. S. Brett, E. S. Ryerson, A. F. Coventry, G. Gallie, W. F. McPhedran, R. G. Armour, D. Graham, C. R. Young, D. G. Hagarty, A. M. Thomas, A. W. McConnell, W. M. Treadgold, B. M. Morris, H. H. Madill, J. R. Cockburn, J. R. Mitchener, V. E. Henderson, H. R. Hopkins, A. R. Leggo, W. S. Wallace, H. G. Manning, all except three being members of the staff, have been appointed officers. The students enrolled enthusiastically, and though the strength authorized as yet is only 1,000, over 1,800 have been taking drill.

On Friday, January 22, 1,500 students with their officers were reviewed by His Royal Highness the Duke of Connaught. He addressed them in part as follows: "I wish to express to you my very great satisfaction with the splendid turnout you have given me this evening. When I looked at you and saw how you stood to attention and the admirable way in which you marched past, I saw that your work since you were formed, a very few months ago, has been performed with a will, and I can honestly say that I have never seen better results than you have shown me to-day.

"What pleases me still more is the splendid example you young gentlemen are showing to the whole of Canada. You have come forward at a moment when every man that is able to do anything to help the Empire in a time of stress is needed, and you have done so readily and in a most efficient manner.

"As an old soldier and as Governor-General of Canada, I wish to say that no parade that I have seen—and I have seen many lately—has given me more satisfaction than your parade this evening."

PHYSICAL PROPERTIES OF COBALT.

The Mines Branch has published the results of further researches on cobalt by Dr. H. T. Kalmus and assistants.

An extended investigation of the metal cobalt, and its alloys, for the purpose of increasing its industrial and economic importance, has been, and is being conducted at the School of Mining, Queen's University, Kingston, Ont., for the Mines Branch of the Department of Mines, Ottawa.

The bulletin just published, "Physical Properties of the Metal Cobalt," has been written by H. T. Kalmus and C. Harper, and is a report on a large number of measurements made at the University laboratories, of some of the important physical and mechanical properties of metallic cobalt. The properties which have been particularly studied are: Density, hardness, melting point, tensile breaking strength, tensile yield point, compressive breaking strength, compressive yield point, rolling and turning properties, electrical resistance, magnetic permeability and specific heat.

NEW YORK MEETING A. I. M. E.

A well attended meeting of the American Institute of Mining Engineers was held in New York at the Engineering Societies building, Feb. 15, 16 and 17. A large number of interesting papers were presented, and some of them provoked lively discussion.

The Monday morning session was chiefly devoted to questions of safety and sanitation. Papers were presented by F. H. Kneeland, H. N. Eavenson, S. Le Fevre and J. Parke Channing.

On Monday afternoon two sections met in separate rooms. One section heard and discussed papers on non-metallic minerals, while the other section devoted its attention to iron and steel.

At the Tuesday morning session a great variety of papers were presented. The subject arousing most interest at this session was the geology of the Butte mining district. The discussion arose from a very interesting account presented by Paul Billingsley of the structural relations at Butte. Owing to the author not being present an interesting paper on metallurgical practice at Porcupine was read by title only and not discussed. This paper is to be presented at the Toronto meeting of the Canadian Mining Institute this week, and will probably be discussed there.

The Tuesday afternoon session was devoted to fuels. Oils and oil well drilling were the chief subjects of discussion. A very interesting exhibition of oils converted into a substance closely resembling crude oils was given. By subjecting ordinary oils, such as kerosene, benzine, etc., to a high pressure in a vessel 3-11 full, a dark colored oil was obtained in every case.

The banquet was held Tuesday evening at the Hotel Astor, and was as usual well attended and a great success.

The Wednesday morning session was chiefly notable for the papers and discussion on the recent advances in copper smelting practice. The large part played in the development of reverberatory furnaces by David H. Browne, J. L. Agnew and others at Copper Cliff received due recognition. Mr. E. P. Mathewson presented L. V. Bender's paper on the practice at Anaconda and supplemented it by much useful information.

At the Wednesday afternoon session one of the most interesting papers was that presented by B. F. Tillson, of the New Jersey Zinc Co., on the "Testing and application of hammer drills." Two papers on mining methods were read by title only and there was consequently little discussion on them.

On Thursday there was an excursion to the Catskill aqueduct and new subway to inspect some of the construction work in progress.

A LARGE MASS OF COPPER.

Houghton.—During 24 hours Trimountain mine, Michigan, hoisted 18 pieces of mass copper averaging a ton each, and 30 tons of mass is now on surface for shipment. All of this has been cut from the large mass discovered early in 1913 at the 25th level.

This mass has been followed from above the 25th level to the 27th, and Superintendent Richard Bowden says the end is not yet in sight. He is certain operations will continue to uncover it for the succeeding year. The immense sheet of solid copper is in the foot wall and not considered as truly a part of the vein matter, but the operation of mining it is comparatively simple. The mass is cut into sections, each weighing about a ton. It is continuous, and varies in thickness from less than an inch to eight inches.

THE TESTING AND APPLICATION OF HAMMER DRILLS*

By Benjamin F. Tillson.

(Continued from Last Issue.)

Perhaps the consideration of the physical phenomena relating to the process of drilling may prove of interest and value.

When rock is excavated by a drill bit three applications of forces seem to be involved—by abrasion, by crushing and by severing or chipping. Although all of these must take place to a certain degree, the greatest amount of useful work is performed when the percentage of force applied to chip reaches a maximum. But in rock it appears that chips can be produced in radically different ways, first, by the severing of molecules, and second, by the reflex forces produced in an elastic medium. To illustrate this, consider the chipping of a comparatively inelastic substance such as lead. With a hammer and chisel, whose axis is inclined considerably from the normal to the surface of a lead block, it is possible to sever the lead and roll up chips, but if the chisel is normal to the surface of a thick block only an indentation can be made and there probably will be a raised area about the indentation to accommodate a certain percentage of the displaced metal. On the other hand, with a highly elastic material, such as glass, the forces impressed by a normally positioned chisel will cause a compression of the molecules, whose elasticity will cause their expansion toward a free, unresisted surface. Since the greatest forces are developed at the surface, since the penetration of the chisel carries some forces to a depth below the surface; and since the chisel surface itself applies some forces at an angle to its axis and impedes the re-expansion of molecules to the space it occupies, therefore, the reflex forces produce more or less cone-shaped chips or flakes and leave a corresponding crater in the block of glass. Now, if the chisel is placed near the edge of a block of glass, the blow upon it will induce stresses to another free face and a correspondingly larger chip will be produced because of the tendency of the forces to seek relief in the shortest direction as well as because of the severing effect. The method of cutting of a drill bit is commonly shown as taking place in this last way with the progressive chipping of a series of benches or steps, but it is doubtful whether such a procedure exists, except in rare instances, for the speed and latitude of rotation between consecutive blows of the drill piston or hammer cannot be controlled with sufficient precision nor adjusted to the various rocks; and an inspection of the cuttings from a drill hole shows them to be flakes, or a crushed and abraded powder.

In the formation of these flaky chips there may be a limiting force of blow for each velocity of impression in order to gain the most useful work (i.e., in the production of flakes), for it appears that beyond certain limits the blows increase the percentage of crushed material and the drilling speed does not vary with the force applied, so that some heavy hitting drills accomplish more in medium-soft ground when a portion of their blows are absorbed by a tappet at the shank end of the steel or by a cushion of water intervening between the bit and the rock. If the force of the blows was lessened by a reduction in air pressure the speed of the piston would be slowed up, and the drilling would suffer from the fewer number of blows per minute.

The transmission of the kinetic energy of the piston to the rock is also influenced by many factors. The blow may be delivered against the rock by the free drill steel which is driven forward through the intervening air or water by the impact of the piston and the velocity of the steel will depend upon the relative masses of the drill steel and piston, the velocity of the piston, and the coefficient of elasticity of the steel, in accordance with the well-known laws of mechanics which deal with elastic or partly elastic bodies and their impact. The drill steel in this way assumes the functions of a "jumper" drill which is driven against and rebounds from the rock at a high frequency, and its action is well seen in most all screw-feed hammer drills with the ringing or jingling of the steel in a drill hole. Another mode of force transmission is by compressional waves, traveling through the drill steel from the shank to the bit. This latter condition brings a cutting effect only when one end of the steel is tight against the rock, but then proves very efficient. Although the air-feed hammer drills usually chatter the steel against the rock, like a projectile shot from the chuck bushing by impacts of the piston, yet it seems possible to approximate the other working condition by designing the air feed so that the pressure is lowered as the piston is traveling on its back stroke (possibly by taking the supply air, for the back stroke, from the air feed) and so that the air feed pressure builds up and forces the drill against the rock just before it is struck by the piston. The reversed air feed may sometimes approximate these conditions and then assist the machine to a higher drilling speed. If hammer drills were made so that the drill steels were always held firmly against the rock, when the piston strikes them, it seems unquestionable that the greatest efficiency of the blows of the piston would result, providing they were properly timed, for no energy would be lost by reason of the inertia of the drill steel, but only that due to heating, resulting from the imperfect elasticity of the metal. The question of the proper timing of the piston blows opens another phase of the matter, namely, the reaction of the rock upon the drill steel; and this effect is the more pronounced with harder rock. It tends to speed up the piston and is so noticeable in running a machine against a metal block as to invalidate, as too high, all air-consumption tests so conducted. The effect of these reactive vibrations upon the drill steel may prove very marked and serious. Where the reactive vibrations interfere with oncoming compressional waves, considerable energy is dissipated, and at times one may be so fortunate as to detect points of increased temperature (probable nodes) upon a drill steel which is cutting ground; and it is no uncommon thing to see a drill steel, in service, break at two points (into three pieces) simultaneously, probably from fatigue because of those vibratory stresses. On the other hand, if these vibrations synchronize at the bit it is quite possible that the chipping forces are greatly augmented, and such an explanation may readily answer those puzzling drill tests in which a dull or broken bit exceeds a finely formed bit in drilling speed. For a long time at Franklin a tally was kept of the different individual drill steels which entered into the testing, with the hope of determining that some particular piece of steel produced the greatest cutting speed, but no con-

*Extract from a paper presented at the New York meeting of the American Institute of Mining Engineers, March, 1915.

clusion could be drawn from the records, except that the changes in length due to resharpening probably masked any possibility of determining the suitable lengths for maximum efficiency. And it seems quite plausible that such a result should be expected if the possible wave lengths of the compressional vibrations in the drill steels are considered. Probably these reactive vibrations occur to a great extent, as well, in the process of drilling, where the steel dances in the chuck and against the rock, for steel breakage appears equally as high, if not higher, with such a type of machine as with the pneumatic feed, and tests comparing these two types for such effects might prove very interesting as well as instructive.

But still other factors influence the force delivered at the rock. If the anvil block or tappet is not in contact with the drill when the piston strikes, a considerable energy loss occurs through the transference of momentum to several pieces. If the steel is bound in the chuck bushing, a great amount of the energy is absorbed by the friction. If the steel is not straight, it loses energy because of the flexure. If the chuck is badly worn, the axis of the steel does not coincide with that of the drill and there is a loss due to the oblique, eccentric impact. If the steel is tight in the drill hole, or if the friction against the side of the hole is great because of its depth, the velocity of the steel, as a projected body, is lessened and the drilling speed is reduced.

The length of the drill steel is an item generally credited as an important influence, and common opinion supports the idea that the cutting speed falls as the length of the steel increases, although some people, on the contrary, feel sure that the long steels drill the fastest. The tests conducted at Franklin do not lend an unqualified support to either view, for the peculiarities of different types of machines play so important a part. For example, if the air feed is very strong in a stoping drill the additional counteracting weight of a long and heavy steel may so improve the working conditions as to indicate a superiority for the long steel, and if the air feed is weak, the reverse may be true; if the drill steel cuts by virtue of a dancing or "jumper" action, the mass added with length may so reduce its velocity against the rock as to bring it below the amount required for efficient chipping; if the piston normally delivers too heavy a blow for the rock, the drilling speed may be improved by the added inertia of the long steel; and if the steel is always against the rock when a blow is delivered, it is doubtful whether the length of the steel plays an important part unless the permitted decrease in the gauge of the drill bits aids the cutting speeds. It is, of course, to be understood that the above considerations of drill steel lengths refer to the performances with bit gauges of the same diameter.

The use of an anvil block is considered by some drill designers to necessitate a loss of from 20 to 30 per cent. of the power of a drill; but actual tests do not always indicate such a condition when the identical steel is tested in the same drill with and without a tappet. The results probably depend upon how frequently the tappet is struck when away from the shank of the steel, and also upon the suitability of the machine to the rock, for if its blows are too heavy the intervention of a loose tappet might reduce their force, with a benefit in drilling speed. The use of water at the bottom of the hole ordinarily consumes about 10 per cent. of the cutting speed if there is no tendency for the drill bits to lose their temper, and compressed air for cleaning the holes encourages a greater drilling speed, providing the cushion of water in the bottom of the hole does not have a benign influence in reducing too powerful a blow upon the rock.

The manner in which a drill is rotated has a bearing upon the amount of work accomplished, and with hand rotated tools, a vigorous rotation with a rapid and wide arc of swing produces the best results; with power-rotated drills it is possible to reach such a speed as to abrade and dull the drill bits, and consequently lessen the drilling speed. It seemed that, with a positive and constant rotation, the axial planes of the cutting edges of the drill bits should be at the same angle with the cut surface as the resultant velocity vector, as estimated for the rotative and striking velocities; and such a bit was tried at Franklin without showing a change in cutting speed, probably because with either bit the chips came out in flakes, as previously described.

Kinetic energy of a blow.—In view of the fact that the subject of hammer drills is more or less in its infancy and literature in regard to them is rather limited, it seems desirable to correct at the earliest opportunity any typographical or other errors which, if accepted without investigation, might work to the detriment of the art of drilling. In this connection it seems that some statements should be corrected in the 1910 edition of Eustace M. Weston's book, Rock Drills, in the chapter Philosophy of Process of Drilling rock, under the sub-heading of hammer drills. In considering the kinetic energy of a blow he states, on p. 139:

"In other words, to double the energy of a blow it would be necessary to double the mass, or weight, if the velocity is the same; but to double the energy, keeping the mass the same, the velocity must be increased four times. The weight of the piston hammer of the largest type of drill is 15 lb. The weight of piston, steel, etc., of a piston drill varies from 60 to 125 lb., so that a blow of equal force can be delivered by a hammer drill only by increasing the velocity of the hammer very greatly. This is acknowledged, for as one hammer-drill maker states, the weight of the piston is one-fourth that of a piston drill; but the velocity is four times as great. To give a blow equal in power it should be sixteen times as great."

A mathemetical error appears to have been made in the premises of Mr. Weston's argument and his consequent deductions as to the practical impossibility of hammer drills being able to compete with piston drills are quite logical, but probably at fault.

If the kinetic energy of a body, such as a drill piston, is designated by K, its velocity by V, and its mass by M, then,

$$K = \tfrac{1}{2}MV^2 \text{ and } K_1 = \tfrac{1}{2}M_1V_1^2.$$

Now if M_1^2 equals M and K_1 is, say, twice the value K, then

$$V_1^2 = 2V^2 \text{ and } V_1 = V\sqrt{2}$$

therefore,

$$V_1 = 1.414V$$

So the velocity of the piston in a hammer drill need be only 1.4 times as great as that when the kinetic energy of the piston is cut in half.

Piston weights.—Again, in the example comparing the piston weights of piston and hammer drills, Mr. Weston appears in error in stating that the velocity should be 16 times as great, for if the piston of a hammer drill is one-fourth the weight of that of the piston drill the velocity of the hammer drill piston need be only twice as great as that of the piston drill in order to deliver blows of the same energy; and the hammer drill will also surpass the piston drill since it will strike twice as many of such blows per minute. The necessity of using high air pressures in hammer drills is only incident to the peculiarity of certain drill designs and is not dependent upon the divorcing of the piston from the steel. If we are to consider the shock upon the parts of two drills of equal

capacity it is evident that with the shorter piston strokes in hammer drills, with the increased number of blows, whose final striking velocity is equal to that of a piston drill under comparison, the weight of the hammer drill piston may be less and the energy in each individual blow may be less in order that the same amount of energy per minute be developed. Therefore, the shocks upon hammer-drill parts are more frequent but not as heavy as the shocks upon piston drills of equal capacity.

Maintenance of drills.—It is extremely difficult to get adequate figures as to the maintenance of drills unless some special forms are kept, which become to all intents a ledger account of each individual drill, for questions naturally arise as to the cost per foot of hole drilled, the length of time the machine has been in service and has been running, the number of holes drilled, the kind of rock encountered and the supply of steel used, as well as the drill parts replaced. The New Jersey Zinc Co. uses a system of punched slips for shift bosses' reports and "drill record" slips are a part of the scheme. These are punched in duplicate by the shift boss and filed at the mine office and main office, where the information is transferred to large sheets, of which each one accommodates the record of one machine for a month, and the footings are carried forward so as to indicate the total work accomplished and maintenance of any machine "to date." The repair parts are designated as to whether they are new or old (second-hand) ones, and original and subsequent drilling-test records are noted on the same summary sheet.

On the record slip and sheet, the location of drills are by top-slice co-ordinates, the class of work (whether raising, drifting, stoping, block-holing or drilling chutes) is indicated, the kind of rock (ore, limestone, gneiss, pegmatite, garnet or feldspar) is punched, and if the machine is idle, broken or being cleaned those points are recorded.

Improvements in drilling methods.—The compressed air rock drill made revolutionary changes in mining methods and in the reduction of mining costs in units of labor per ton of ore, and at Franklin even more marked savings have been made through the development of hammer drills. There, in the days of hand drilling, a total of 8 ft. in three drill holes with varying diameters of 1¾ to 1¼ in. was considered a fair 10 hour shift's work, and possibly 8 tons of ore would be broken per drill shift or 4 tons per man shift. With 3 in. reciprocating rock drills from 20 to 40 ft. of drill holes, ranging in diameter from 2½ to 1½ in., would be the average work for a 10 hour shift, although on rare occasions some men might drill as much as 80 or 90 ft. of holes in a shift, and possibly 20 tons of ore would be broken per shift, or 10 tons per man shift, since two men were needed on a drill. It seems that as a rule a greater tonnage per foot of hole was obtained with hand drilling because of the fact that, rather than dismount and reset heavy drill columns, machine men would tend to place as many holes as possible from one set-up, therefore many holes were placed disadvantageously for breaking efficiency. Another cause, which would contribute to the same results, would be the difficulty of starting holes with piston drills on uneven sloping faces, so that holes were frequently deflected from the direction in which they were supposed to be placed. These figures would lead to the rough estimate that 2½ times as much tonnage per drilling man shift was accomplished by piston drills as by hand drilling.

With hammer drills 80 to 100 ft. of 1¾ to 1¼ in. drill holes are placed by one man in a 10 hour shift, about 150 to 200 tons of ore will be broken per drill shift and the same amount per drilling man shift, or 15 to 20 times the amount broken per man with reciprocating drills. Of course the entire credit for such increase in tonnage cannot be given to the type of drill, for improved organization, system of working, and supervision have undoubtedly played an important part; but the greater mobility and flexibility of the light hammer drills have permitted and encouraged a more efficient placing of drill holes; have cut in half the labor necessary to run a drill; and permitted a more effective supervision and mining scheme. The actual tonnage broken per man working in a stope will not be so high, comparatively, since it has been found worth while to place additional men in stopes to sledge and block-hole large chunks of ore, which were formerly often allowed to become buried and proved obstacles to high trimming efficiency by blocking chutes through which the shrinkage stopes were drawn into tram cars.

Table II. shows the gains which have been made with the adoption of hammer drills by the New Jersey Zinc Co. It is to be regretted that no records of tonnage and labor were available for earlier years, so as to cover the average efficiencies before the advent of hammer drills and back to the days of hand drilling. The different divisions of mining work are classified in this table as drifting, raising, stoping and open cut or quarry, and it may be interesting to summarize the important features, reducing the labor to an hourly basis, inasmuch as a change was made from a 10 hour to an 8 hour shift basis in July, 1913.

Date	Drifting										
Year	Footage Advance	Drill Shifts per Foot Advance	Type of Drills, Per Cent.		Per Cent. Size of Powder, 50 Per Cent. Strength		No. Caps per Foot	Powder in Sticks per		Explos Cost per Ft. Advance	Runners and Helpers per Foot Advance
			H. D.	P.	1⅛ in.	1 in.		Foot Advance	Drill Shifts		
1908[a]	494	1.45	......	....	......	......	.....	36.4	25.2	......	......
1909	4,890	1.31	......	....	......	......	.....	32.7	25.0	......	......
1910	4,909	0.74	......	99.2	73	27	5.43	31.1	42.5	$1.84	1.84
1911	2,814	0.63	......	99.2	96	4	4.95	26 5	41.9	$1.59	1.71
1912	374	0.44	100	.....	11	89	7.40	36.4	89.6	$1.61	0.84
1913	905	0.33	100	......	......	100	5.56	34.6	106.0	$1.40	0.59

[a] Last 4 months.

Date	Raising										
Year	Footage Advance	Drill Shifts per Foot Advance	Type of Drills, Per Cent.		Per Cent. Size of Powder, 50 Per Cent. Strength		No. Caps per Foot	Powder in Sticks per		Explos. Cost per Ft Advance	Runners and Helpers per Foot Advance
			H. D.	P.	1⅛ in.	1 in.		Foot Advance	Drill Shifts		
1908	715	1 18	......	..	......	......	.....	27.7	23.4	......	....
1909	5,446	0.90	......	....	......	......	.....	29.3	32.4	......	....
1910	4,257	0 44	97.0	...	16	84	5.11	27.4	62.7	$1.54	0.78
1911	1,865	0.23	98 5	...	8	92	4 38	21.5	92.5	$1.04	0.65
1912	1,311	0.17	100.0	..	2	98	3.46	20.1	115.0	$0.93	0.48
1913	2,306	0.20	100.0	...	1	99	3 94	21.4	106.2	$1.03	0.58

Date	Stoping (active)												
Year	Net Tons Ore Broken	Type of Drills, Per Cent.			Net Tons Broken, Excl. B. H. Drills per Drill Shift	Per Cent. Size of Powder, 50 Per Cent. Strength		No. Caps per Foot	Powder in Sticks per		Explos. Cost per Net Ton Broken	Net Tons Broken per Man in Stope	Remarks
		B. H.	H. D.	P.		1⅛ in.	1 in.		Net Ton	Drill Excl. B. H Shift			
1908	57,000b	....	....	....	23.4	....	....	.....	0.76	17.7	....	....	
										19.3			
1909	361,000	7.0	24.5	68.5	20.5	....	....	.....	1.01	20.7	....	....	
1910	337,000	12.7	62.3	25.0	38.1	16	84	0.310	1.025	39.0	$0.055	13.2	
1911	386,000	30.1	55.8	14.1	121.0	11	89	0.356	0.77	95.8	$0.041	20.3	
1912	427,000	35.5	62.0	2.5	195.0	6	94	0.415	0.86	108.3	$0.045	25.6	
1913	494,330	30.3	69.7	....	170.0	2	98	0.420	0.89	233.0	$0.049	26.7	

[b] Two months, estimated.

Table II.—Annual Comparisons of Mining Efficiencies with Piston and Hammer Drills.

Drifting.—There have been no radical changes in the placing of the drill holes in drifts since the adoption of the air feed hammer drill for this work, but one

man with a single machine is now placed in a heading; he is instructed to "pull" a "round" each 8 hour shift, stopping overtime if necessary, and to accomplish an advance of 3½ to 4 ft. per round. Two men operating a reciprocating rock drill formerly made an advance of a 5 to 6 ft. round in five 10 hour shifts. So the drilling labor (runners and helpers) per ft. of advance averages 18.4 hours for the entire mine during the year 1910, when reciprocating rock drills were solely in use. As shown by the average for 1913, hammer drills have reduced this figure to 5.7 hours per ft. of advance, or about one-third the former labor of drilling and blasting. The explosive costs have also been reduced by the use of hammer drills from the figure of $1.84 per foot of drift during 1910 to $1.40 per ft. in 1913, for two probable reasons.

First, hammer drills permit the placing of the drill holes smaller in diameter than those bored by reciprocating drills, so that an unnecessary amount of explosive is not required merely to fill the holes sufficiently to distribute the force of the explosion.

Second, the flexibility and ease of rigging the light hammer drills permit and encourage a more efficient placing of drill holes. The almost exclusive use of 1 by 8 in. explosive cartridges now, as contrasted with the 1⅛ by 8 in. cartridges formerly used, demonstrates the first contention, for in terms of 1 in. powder, the equivalent of 36.8 sticks per ft. of drift was used in 1910, and 34.6 sticks per ft. in 1913. The drill shifts per ft. of advance have been lowered from 0.44 in 1910 to 0.20 in 1913, and the corresponding drill hours from 4.4 to 1.8.

The different drifts may vary in size from 6 by 7 ft. to 8 by 11 ft. in section, and perhaps 7 by 8 ft. is an average section. Because of the compact, tough nature of the ground, it requires from 20 to 30 drill holes in a round, and 24 would be a fair average, so the drilling operation is an important factor of the drifting costs. The following comparison of the average drifting costs for each year shows the saving which has been possible because of hammer drills; but only the cost of drilling labor and explosives is considered. The record drift in 1913 was driven for $2.06 per ft.

	1910.	1911.	1912.	1913.
Drifting cost per ft.	$5.33	$4.92	$3.35	$2.70

Raising.—In 1908, using 2¼ in. piston reciprocating rock drills, 0.7 ft. of 6 by 6 ft. raise per 10 hour drill shift was made with a labor expense of 28.5 man hours per ft. of raise. About 27 ft. of drill holes were placed per shift, 24 holes were placed in a round, and 16 lb. of explosives were used per foot of raise advance, at a cost of $2.70 per ft. for supplies. Since labor was then paid $2 and $1.55 per 10 hour shift, the total cost of raising was approximately $7.50 per ft. of advance.

During the same year, 1908, hammer drills were introduced, and an advance of about 1.5 ft. per drill shift was made with a labor expense of 13.3 man hours per ft. of advance. About 50 ft. of drill holes were placed per shift, 24 holes per 5 ft. round, and 10 lb. of explosives were used per ft. of advance, at a cost of $1.75 per ft. for supplies and a total cost of $4.10 per ft. of raise, or only 55 per cent. of the cost with the reciprocating rock drills.

The development of hammer drills with increased drilling speed permitted the reduction of the drilling labor to 7.8 hours per ft. of raise advance, and the explosives cost to $1.54 per ft. of raising done in the year 1910; and a further reduction to 4.8 hours of drilling labor during 1912, and an explosive cost of $0.93 per ft., although the wages were $2.20 and $1.70 per 10 hour shift. These costs rose slightly in 1913, since wages rose to $2.25 and $1.85 for 10 hour shifts, and in July of the same year the working hours were lessened from 10 to 8 and the hourly wage was increased to $0.281 and $0.231. However, the cost per foot was then only 5.2 hours of drilling labor and $1.03 per ft. for explosives. About 18 drill holes are now placed to pull a 5 ft. round and two men are expected to blast a round each 8 hour shift and are each paid 11 hours' time for performing the task.

The average raising costs for operating labor and explosives have been as follows:

	1910.	1911.	1912.	1913.
Raising cost per ft.	$2.95	$2.31	$1.88	$2.22

The record raise (of about 50 ft. in length) for 1913 had a cost of $1.65 per ft., and the record long raise (about 100 ft. long) had a cost of $2.09 per ft., with explosive costs, respectively, of $0.77 and $0.99 per ft. of raise.

Stoping.—In 1909, when about 74 per cent. of those drills placing holes in the solid orebody were of the reciprocating type of 3-in. piston diameter, the ore production averaged about 20 net tons of ore broken from the solid per 10 hour drill shift, with an equivalent of 1.1 sticks of 1 by 8 in. of 50 per cent. dynamite per ton of ore.

In 1910, when about 72 per cent. of the producing drills were air feed stoping (hammer) drills, the tonnage per drill shift rose to 38 net tons with about the same amount of explosive (which cost $0.055 per net ton of ore broken), and 13.2 tons were broken per 10 hour shift of men working in stopes, or 1.32 tons per hour. Although there is no record of the breaking labor prior to this year, the fact remains that in the actual running of the drills only one man was used with a hammer drill while two men were employed with each reciprocating drill.

In 1911, when the hammer drills were about 80 per cent. of the total, the stoping efficiency profited by the improvements in the drilling speed of the hammer drills, and 121 net tons were broken from the solid per drill shift with about 0.8 stick of 50 per cent. 1 by 8 in. dynamite per ton (at an explosive cost of $0.041 per ton), and 2.03 net tons were broken per man hour of men working in stopes.

In 1912, when about 98 per cent. of the stoping drills were hammer drills, 195 net tons were broken per drill shift with about 0.87 stick of 50 per cent. 1 by 8 in. dynamite per ton (at an explosive cost of $0.045 per ton), and at the rate of 2.56 net tons per man hour in the stopes.

In 1913, when all the stoping drills were hammer drills, the length of the working shift was reduced from 10 to 8 hours in the middle of the year and the tonnage broken per drill shift fell proportionately to 170 net tons, but remained at approximately the same hourly rating as for the year 1912. However, the tonnage broken per man shift in the stopes increased slightly to 26.7 net tons, at an explosive cost of $0.049 per ton, with the consumption of 0.89 stick of 50 per cent. 1 by 8 in. dynamite per ton. The tonnage broken per man hour was 2.97, which showed a steady gain over previous years.

It should be noted that the explosives charged against stoping include those used by the trammers in blasting ore in the chutes, and thus represent all the dynamite necessary to reduce the ore to the proper size for being handled through chutes and in the mill.

Opencut.—In order to provide broken rock for filling material to fill empty stopes to support the remaining orebody, "mill-holes" are developed in limestone

country rock at the surface. For some years it was the practice to use 30 ft. bench-holes in the opencut for quarrying the rock, both 3 in. and 3½ in. reciprocating rock drills being used. It took steady work for two men to sink one 30 ft. hole in a 10 hour shift, and their work was hazardous because of the inconvenient localities where set-ups were made, and because of the clumsy weight of their machines and the long, heavy drill steels which were handled. After the success of hammer drills in the underground mining operations, they were tried in the opencut work in 1912. Small holes were drilled to an average depth of 16 ft., and were given lighter burdens than had previously been the practice, for the object was to distribute the dynamite more evenly in the rock, as contrasted to churn drill or mammoth blasts. In the tough, crystalline Franklin limestone this application of hammer drills to quarrying has proved superior to the heavy or mammoth blasts, for the same tonnage can be produced from a bench with a saving of labor and powder, since a great amount of expensive blockholing is avoided. A machine will drill about 100 ft. of holes in a shift with a heavy hammer drill and two men can drill only 30 ft. with a rock drill.

TAR SANDS OF ALBERTA

The existence of deposits of bituminous sands in the McMurray district of Nothern Alberta has been known for many years. The absence of transportation facilities has, however, prevented the utilization and even the prospecting of these deposits.

Anticipating the building of the Alberta and Great Waterways Railway into Northern Alberta, a preliminary examination of the deposits was undertaken by the Dominion Mines Branch in 1913 and continued in 1914. Meanwhile, the construction of the railway, which will open up and render these deposits available, is being rushed, and its completion is expected in 1916.

The investigation revealed the fact that the tonnage of bituminous sands in the McMurray area is very large, and, although much of the material is low grade and in some cases the overburden so heavy that mining by open-cut is impracticable, it is found that some 20 per cent. of the material, representing many millions of tons, may be considered as of commercial value.

Bituminous sands have for a number of years been used in the construction of various classes of pavements in the United States. The extent to which the material has been used appears to have been largely determined by the freight rates. The greater portion of the bituminous sand used at the present time in California for paving purposes comes from the Santa Cruz quarries, and is, in many respects, similar to the Alberta material. The bitumen contained in the McMurray rock is, however, much softer. It is believed that, with proper manipulation, such as heating, and the addition of hardening flux, the penetration of the bitumen can be reduced to meet the requirements of standard specifications for its successful employment in the laying of pavements in substitution of imported asphalt.

In view of the fact that the bitumen contained in the tar sands of Alberta is softer than the bitumen of the California material, arrangements have been made by the Mines Branch for the laying of an experimental pavement in the city of Edmonton with the Alberta material, the city government having agreed to construct the concrete foundation. Upward of sixty tons of suitable material has been assembled for transportation to Edmonton, and it is expected that the pavement will be laid next summer.

The City Commissioner states that: "If this work is successfully carried out it will be of greater value to the city of Edmonton and Alberta generally than the bringing in of half a dozen industries. . . . at the present time, we are absolutely suffering for the lack of cheap pavement and for the lack of good road material, whereby the farmers may haul their products to the city on well built roads. The solution of this problem will be worth millions of dollars. . . . ."

At present, all asphaltic paving materials used in Canada are imported from foreign countries. In 1913-1914 the value of these imports reached a total of nearly $900,000 and the consumption is rapidly increasing. The value of a cheap and satisfactory paving material in Western Canada would be very great.

The bituminous sands may also serve as a source of pure bitumen, which may be extracted either by disulphide of carbon, the lighter petroleum distillates, or by the use of hot water and steam. Among the many uses to which this extracted bitumen may be applied may be mentioned floorings for many classes of buildings—such as mills, hospitals, schools, skating rinks—for foundations which require to absorb vibration and jars, as in electric power plants, for lining and damp courses for cellars, reservoirs, etc., for insulation of pipes, and as a source of asphaltic oils.

Attempts in this direction have been made for the past twenty years in the United States. No industry however, has been established and no extracting plant is now in operation. The cause for the failures is not far to seek. In California extracted bitumen, at $12 per ton, cannot compete with petroleum residuum at $6.50 to $9.00 per ton. In Alberta, however, bitumen extracted at $12 would compete with imported refined asphalt, costing $27 to $34 per ton, delivered.

Before such an industry, however, is attempted, all available information of the results of many years' serious and often costly experimentation in the United States should be consulted.—Dr. Haanel, at the Annual Meeting of the Commission of Conservation.

GRANBY.

According to reports from Boston two more furnaces of the Grand Forks smelter have been blown in by Granby Consolidated, making six sections of that plant now in operation. Within another month the two idle furnaces will also have been blown in, thereby placing the entire battery of eight in commission.

The Hidden Creek smelter continues to operate two of its three furnaces; but the capacity of that plant will be increased fully 25 per cent. by the erection of a fourth furnace, orders for which have already been placed. This will permit of the steady operation of three furnaces at Anyox, leaving a fourth furnace in reserve.

Through lack of sufficient water at Hidden Creek, Granby has lately been shipping matte from that property to the Grand Forks smelter for conversion into blister copper. As the company secured an "in transit" rate of but 25 cents a ton for the transportation of this material it was considered a good step to take.

By July next Granby should be in position to treat 2,500 tons of ore daily at Hidden Creek, in addition to a normal quota of ore at the Grand Forks plant. From current operations the company is understood to be earning in excess of $100,000 a month.

SHIPMENTS FROM COBALT.

According to the Cobalt Nugget shipments of ore and bullion for the week ending Feb. 19 were far below the average, only one small bullion shipment and three cars of ore appearing on the weekly list.

Chambers-Ferland made its first appearance of the year with a car of concentrates shipped to Newark, N.J. The concentrates ran about 700 oz. to the ton and was the first shipment made since early November of last year. The concentrates for the low grade treated at the Northern Customs mill has been stored owing to conditions, but it is likely that more shipments will be made shortly. The Temiskaming sent out a car of high grade, containing ore mined from the new discovery made from the 530 ft. level of the Beaver workings. A car of high grade from the Townsite-City completed the week's list.

The bullion shipments have been lower during the past few weeks, due principally to the annual clean-up at the Nipissing high grade mill. The big mine has not made a bullion shipment in three weeks, but the mill is now in readiness to be in operation within a few days. The shortage of power also assisted to keep the bullion shipments below normal. O'Brien's 23 bar consignment was the only bullion to leave the camp in the week.

The ore shipments, in lbs., were:

Chambers-Ferland	79,980
Temiskaming	87,345
Mining Corp. of Canada—	
Townsite City	77,044

PULVERIZERS.

The Jeffrey Manufacturing Company, of Columbus, Ohio, have recently issued a new 48 page bulletin, No. 147, illustrating and describing the prominent features of their complete line of swing hammer pulverizers, giving full information regarding capacities, speeds, horse power, general dimensions, etc. More than 1,000 of these machines are now in daily operation reducing limestone, shale, gypsum, clay, coal, coke, ores, tankage, bark, oyster shells, rock for road top dressing and many other materials. A free copy of this bulletin may be obtained by writing to their home office.

ANTIMONY DEPOSITS AT LAKE GEORGE, YORK COUNTY, NEW BRUNSWICK.

According to the Fredericton Board of Trade a valuable and extensive deposit of sulphide of antimony was discovered in 1863 in York County, N.B., 24 miles from Fredericton. Between 1870 and 1885 at least three companies operated, and for the most part very successfully. From 1909 to 1910 a company operated one of these mines, and expended a considerable sum in modern equipment, buildings and machinery, which are kept in good condition. This company was obliged to close down owing to the price then prevailing for antimony in its marketable condition, and the long distance haul to the then nearest railway shipping point, 13 miles. Since then the St. John and Quebec Railway has been built, and is now regularly operated by the Intercolonial Railway as a part of that system. The distance to the latter railway is now only three miles, with a down grade all the way.

This metal is used as an alloy for making babbitt metal, Britannia metal, music plates, machinery bearings (for high speed), bells, projectiles, enamelling, manufacture of glass, paints, vulcanizing rubber, and for hardening bullets and shot.

At the present time the price is more than double what it was when the work closed down in 1910. With the greatly improved shipping facilities, the opportunity for reviving this industry is most favorable.

As this metal is comparatively rare, there would be in ordinary times a market for all that could be produced.

M. C. M. MEN IN NEW YORK.

During the recent meeting of the American Institute of Mining Engineers in New York, Michigan College of Mines men gathered at the Engineers' Club for luncheon, and swaped stories and experiences. There were present: Wm. Kelly, Dr. F. W. McNair, Dr. A. C. Lane, W. E. Parnell, F. F. Sharpless, Louis Wright, C. V. Drew, W. L. Cumings, Ed. Russell, C. B. Dunster, F. W. O'Neil, B. B. Hood, A. E. May, J. S. Dunstan, Clarence Boyle, F. J. Hollis, J. M. Longyear, Jr., F. B. Burrall, Wm. G. Schneidler, Leo F. Arnold, M. S. Walker, W. E. Segsworth, W. Judson, Scott Turner, G. Rizo Patron, W. Baggaley, R. M. White, Ernest Klepetko and R. E. Hore.

Mr. Scott Turner, who is general manager of the Arctic Coal Co., gave an interesting account of the development of the company's coal mines in Spitzbergen. Under very severe conditions Mr. J. M. Longyear and his associates have developed, in what was formerly a desolate region and uninhabited even by Eskimos, a successful enterprise.

Mr. W. L. Cumings, of the Bethlehem Steel Co., gave an account of visits to mines in South American countries, from which he has recently returned.

It was decided to form an eastern Alumni Club and arrange to hold luncheons regularly in New York.

GERMANY'S INVASIONS.

The Wall Street Journal says:

That seventh and latest threatened invasion of England, directly or through her maritime commerce, by submarine attack, must now be put into execution or classed with the six preceding threats.

It is worth while to recall what those threats were, particularly in view of their virtually negligible military value:

First—The British Empire, being held together by imperial power, must break up as a result of war with united and homogeneous Germany. India, South Africa, Egypt and Ireland were to fight England for their freedom at this heaven-sent opportunity; while Canada was to annex herself to the United States, and Australia would seize the chance to declare her independence.

Second—England's commerce would be invaded, and largely destroyed, by the roving warships of Germany.

Third—The English navy would be worn down by piecemeal destruction, called "attrition," until the German fleet could safely give battle to what was left of it.

Fourth—A fleet of Zeppelins would invade England, attacking her coast defences, and laying waste her greatest cities.

Fifth—On the taking of Dunkirk and Calais, new Krupp guns, mounted on the Continental coast, would shell the opposite English shore, making a special Krupp invasion of England.

Sixth—A fleet of transports was forming for the land invasion of England by the German army.

The war has now progressed more than six months without any material development from these threats. Is it to be taken that the threat department of the German general staff in the Wilhelm Strasse is a specimen of the wonderful efficiency of the great war machine?

HANDING DOWN

By Harold Begbie, in London Chronicle.

Soldier what are you writing
  By the side of your cooling gun?
Sir, since I'm stopped from fighting,
  A word to my little son.

Tell me the thing you've written,
  For I love the writer's art;
Sir, that to be a Briton
  Is worth a broken heart.

Show me so fine a letter
  That you write in trench's mud;
Sir, you could read it better
  Were it not for the stain of blood.

Soldier, tell me your story—
  Your eyes grow bright and wide;
Sir, it's a taste of glory
  To think of the young one's pride!

Would you like to be a soldier, little Tommy-all-my-own,
Would you like to tip the Kaiser off his high and mighty throne,
Would you like to be with father in a well-dug trench,
Knocking spots off German generals and saluting General French?

Would I like to be with Tommy, little Tommy-all-my-own,
Would I give a month of Sundays just to see how he has grown?
Yes! I'd like to be a dustman in the poorest London streets
For the chance of seeing Tommy with a gumboil made of sweets.

If you want to be where I am, then I want to be with you,
But I'm here to show a tyrant that a Briton's word is true;
We must stand by little Belgium, we must fight till fighting ends,
We must show the foes of Britain that we don't desert our friends.

Don't you go and think my Tommy, little Tommy-all-my-own,
That we're squabbling here for nothing, that we're growling for a bone;
We are here for Britain's honor, for our freedom, for our peace,
And we're also here, my Tommy, that these wicked wars may cease.

Don't you say that I am funky, don't you say that I am sick,
Boy, I'm half afraid to tell you, but I love it when it's thick—
When the shells come screaming, bursting and whistling bullets wail;
God forgive me, but I love it, and I fight with tooth and nail.

But it's after—looking round us, missing friends, and finding dead,
It is then the British soldier gets a fancy in his head;
And he swears by God in heaven that the man who starts a war
Should go swimming into judgment down a cataract of gore.

That's what makes us such great fighters, and I'd have you be the same;
Love your country like a good 'un, hold your head up, play the game.
Be a straight and pleasant neighbor, be a cool, unruffled man,
But when bullies want a thrashing, why you thrash 'em all you can.

While you say your prayers, my Tommy, little Tommy-all-my-own,
Asking God to save your daddy, I send this one to His Throne:—
Save my little lad from slaughter, guard his heart and mind from wrong,
Keep him sweet and kind and gentle, yes, but make him awful strong.

Good night, my little Tommy, here's your daddy's good-bye kiss,
Don't forget what I have told you, and remember also this—
If I don't come back to see you I shall die without a groan,
For it's great to fall for freedom, little Tommy-all-my-own.

CORRESPONDENCE

INDUSTRIAL ACCIDENTS.

To the Editor of the Canadian Mining Journal:

Sir,—A contributor, "D," to your February issue, page 75, referring to the matter of accident prevention, remarks: "While no statistics of the accidents occurring throughout Canada are avaiable," etc. In some senses, no doubt, there is ground for the view expressed by your contributor, who may not have been, however, aware of the extent to which information on this subject is gathered and compiled by the Department of Labor for publication monthly in the Labor Gazette and annually in a carefully compiled statement printed in the annual departmental report, as well as in the Labor Gazette. The facilities and authorities of the department do not perhaps permit the record to be exhaustive, but the report furnished contains a large amount of what is believed to be pertinent and valuable information on industrial accidents. The department receives regularly from the various branches of the different Provincial Governments, also from different Dominion authorities collecting statistics of a particular class, reports based on returns collected by these officials, and, by extensive correspondence and a careful and comprehensive clipping system, collects particulars also of a large number of accidents in occupations not under official regulation. In this way information was gathered during the calendar year 1913 concerning 1,500 fatal and 7,195 non-fatal accidents.

Yours, etc.,

F. A. ACLAND,
Deputy Minister of Labor.

Ottawa, Feb. 11, 1915.

PERSONAL AND GENERAL

Mr. F. H. Shepherd, M.P. for Nanaimo, Vancouver Island, B.C., has been appointed chairman of the Mining Committee of the House of Commons, Ottawa.

Mr. Frederic Keffer, of Greenwood, Boundary district of British Columbia, is now practising as a consulting mining engineer on his own account after having been with the British Columbia Copper Co. ever since its inception in the spring of 1898.

Mr. Robert Johnston, for eight years chief electrician for the Crow's Nest Pass Coal Co. at its Coal Creek colliery, and who also has had charge of the company's mine-rescue apparatus at Coal Creek, near Fernie, has gone to England on an extended trip.

Mr. O. E. S. Whiteside, of Coleman, Alberta, general manager for the International Coal and Coke Co., was in Nelson, B.C., on February 9 on his way to Spokane, Washington.

Mr. Lorne A. Campbell, general manager for the West Kootenay Power and Light Co., who represents Rossland constituency in the Legislative Assembly of British Columbia, has been appointed chairman of the mining standing committee of that body.

Mr. T. J. Vaughan-Rhys, for several years connected with mining in the Portland Canal district of British Columbia, is now developing a mine situated near Rocher Deboule mountain, a few miles from New Hazelton, in the Skeena district of that province.

Mr. C. P. Hill, of Montreal, Quebec, vice-president of the Pacific Coast Coal Mines, Ltd., operating coal mines on Vancouver Island, B.C., is at Victoria, looking into the situation brought about by the recent disastrous flooding of the company's South Wellington coal mine, situated four or five miles from Nanaimo, V.I.

Mr. John L. Retallack, of Kaslo, B.C., for many years actively associated with mining in Ainsworth and Slocan divisions, has been appointed quartermaster of the British Columbia division of the Third Canadian Contingent, and is now with the troops in training at Victoria, B.C.

Mr. George O'Brien, instructor in training at the Provincial Government mine-rescue station at Fernie, Crow's Nest Pass, B.C., has been gazetted a district inspector of mines in British Columbia, a vacancy in the inspection staff having been caused by the death of the late Mr. Evan Evans at the Coal Creek mines on January 2.

Mr. A. Gordon French, metallurgical chemist, who in 1911 claimed to have found platinum in commercial quantities in dikes on mineral claims near Nelson, B.C., and who also about that time was engaged in conducting a series of experiments in Nelson with the object of separating and saving zinc occurring in conjunction with silver-lead and iron in ores from Slocan district of British Columbia, left Kootenay on Feb. 11 for Boston en route to Glasgow, Scotland.

Mr. Howard W. DuBois, of Philadelphia, Pa., managing director of the Quesnelle Hydraulic Gold Mining Co., which in recent years expended about $1,000,000 on an important water supply system to provide for extensive hydraulicking operations on its placer-gold leases in Quesnel mining division of Cariboo district, British Columbia, spent a week or two in Victoria last month on business connected with the mining interests he represents. Last year Mr. DuBois was occupied in Alaska, where his principals have other mining interests.

The second Canadian and International Good Roads Convention and Exhibition will be held at Convocation Hall, University of Toronto, March 22 to 26, 1915.

Of the Toronto members of the American Institute of Mining Engineers there were present at the New York meeting last week, J. B. Tyrrell, W. E. Segsworth, J. M. Clark and R. E. Hore.

Mr. Wakely A. Williams, of Anyox, Observatory Inlet, B.C., smeltery superintendent for the Granby Consolidated M. S. and P. Co., went to New York last month to there meet the directors of the company with the general manager, Mr. F. M. Sylvester, of Vancouver, B.C.

The Provincial Mineralogist for British Columbia has prepared the customary "Preliminary Review and Estimate of Mineral Production," for 1914, which the Bureau of Mines of that Province issues early in each year, giving brief information of the progress and production of the mining industry several months in advance of publication of the larger "Annual Report of the Minister of Mines for British Columbia."

Prof. Arthur Lakes, of Denver, Colorado, who for some months has been living with his son, Mr. Arthur Lakes, Jr., manager of the Ymir-Wilcox gold mine, near Ymir, Nelson mining division of British Columbia, has arranged to give a series of at least four lectures at Nelson under the auspices of the local Y. M. C. A. His subject will be, says the Daily News, "The Discovery of Fossil Monsters in Western America." The date of the first lecture was fixed for February 4.

Several weeks ago Mr. J. W. D. Moodie, vice-president and general manager of the Britannia Mining and Smelting Co., Ltd., operating the Britannia copper mine and concentrating plant near Howe sound, Vancouver mining division, British Columbia, sustained a severe loss in the death of his wife, after only a brief illness. Mrs. Moodie's body was taken to southern California, where her immediate relations reside, for interment there. It was accompanied by the bereaved husband and family of young children. Afterward Mr. Moodie went to New York City, where the Howe Sound Copper Co., which controls the Britannia Co., has its headquarters. He was expected to return to Britannia Beach, B.C., early in February.

Mr. S. S. Fowler, general manager for the New Canadian Metal Co., operating the Bluebell lead mine and concentrating mill at Riondel, Kootenay lake, B.C., was in Vancouver recently; he left that city on Feb. 17 for Ontario with the object of attending the annual meeting of the Canadian Branch of the St. John Ambulance Association as one of two delegates from British Columbia, and the seventeenth annual meeting of the Canadian Mining Institute at Toronto as the official representative of the Western Branch of the Institute, of which branch he is chairman for the year.

Two more western mining men have lately been bereaved by the death of their respective wives. These are Mr. Melbourne Bailey, manager of the John Hopp placer gold mines near Barkerville, Cariboo district of British Columbia, and Mr. J. H. McMillan, manager of Nos. 5 and 6 mines, Comox colliery, Cumberland, Vancouver Island, B.C. Mrs. McMillan was the granddaughter of the first white settler in Comox valley—Mr. Adam McKelvie—who went there in August, 1862.

Mr. D. G. Small, of Porcupine, was in Toronto last week.

The Council of the Canadian Mining Institute has recommended that Sir Richard McBride, Premier and Minister of Mines of British Columbia; Hon. G. Howard Ferguson, Minister of Mines of Ontario; and Hon. H. Mercier, Minister of Mines of Quebec, be elected honorary members of the Institute.

Mr. J. B. Tyrrell has returned to Toronto from New York, where he presented a paper on the Beauce gold deposits, Quebec, at the annual meeting of the American Institute of Mining Engineers.

Mr. R. E. Hore has returned to Toronto from New York.

On January 30, the Rossland Miner published a paragraph stating that "Mr. James Cronin, the well-known mining man of the early Kootenays, is reported to have suffered a paralytic stroke at Spokane." Happily the report was incorrect, for late in January Mr. Cronin reached Victoria fit and well, having just returned south after a field season spent developing lode-mining property in the Babine region of Omineca mining division, and on February 2 he was still in the capital city of British Columbia as hearty and energetic as ever.

Mr. A. Fournier, as he was known during the several years he was managing a mining company for French shareholders having a silver-lead mine and concentrating mill on the South Fork of Kaslo creek, in Ainsworth mining division, British Columbia, but Captain Fournier when he rejoined his regiment in France after the outbreak of the war, has been taken prisoner by the Germans. After his return to France he was made a commandant and was soon at the front. Madame Fournier, who also returned to France, was informed by the French military authorities that her husband had been killed in action; but just after she had arranged for masses to be said for the repose of his soul, she received a telegram from him informing her that he and his son were prisoners and that their captors were treating them kindly.

The Jeffrey Manufacturing Company has issued a bulletin illustrating and describing belt conveyor equipments, and another bulletin describing malleable and steel elevator buckets.

HILLCREST CO.'S COMPENSATION LIABILITY.

A press despatch from Lethbridge, Alberta, is as follows: "Under the Alberta Workmen's Compensation Act the Hillcrest Collieries will pay over to the dependents of the miners who lost their lives in the Hillcrest coal mine, in southwest Alberta, on June 19 last, approximately $250,000.

"The agreement between the company and the representatives of the United Mine Workers of America provides for payment of the full amount of compensation, namely, $1,800, to the dependents of 57 deceased miners, and it is the opinion of the officials of the union that the number will be brought up to 90.

"Thirty-two of the deceased men were Austrians. Their rights have been acknowledged by the company, but no compensation will be paid their dependents who reside in Austria until peace has been declared between Austria and Great Britain."

It may be pointed out that there is a discrepancy in the figures above quoted, for even if payment be made in the larger number estimated, namely 90, a total of only $162,000 will thus be accounted for.

COAL MINE DISASTER IN BRITISH COLUMBIA.

A serious and fatal disaster occurred at the South Wellington colliery of the Pacific Coast Coal Mines, Ltd., situated within five miles of Nanaimo, Vancouver Island, British Columbia, on the morning of Feb. 9, when the company's Fiddick mine was flooded, it is thought, by breaking into old mine workings of an adjacent property that had not been worked for twenty years or more. So far as known 19 men were drowned, including Joseph Foy, the mine manager, who was overwhelmed by a cave caused by the incoming water when he was endeavoring to rescue some of those known to be farther in the mine.

Until the mine shall have been unwatered so that an examination may be made, the exact cause of the disaster can only be surmised. What is known, however, is that after a blast had been fired there was a sudden rush of water, which in a short time filled the lower workings of the Fiddick mine. Mr. John H. Tonkin, of Victoria, president and general manager of the company, has been quoted in district newspapers as having stated that the company's mine maps made it appear that the Fiddick workings were not within hundreds of feet of the old Alexandra mine workings, abandoned years ago, after the mine had been operated by the Vancouver Coal Co., which also owned the No. 1 Shaft and other mines about Nanaimo prior to sale to the Western Fuel Co. He said, further, that every precaution had been taken to allow plenty of barrier space between the Fiddick workings and the parts shown on a registered map to have been worked when the Alexandra mine was in operation. According to the Fiddick mine map, there had been left a solid wall of 100 ft. of coal between the part where the flooding occurred and the boundary of the Alexandra property. The Provincial Government district mine inspector promptly took charge of the mine, and several big electrically operated pumps are now being used to free the mine from water, but it may take a couple of months to do this.

The official report for 1914 on this property is not yet available, but the published report of the district inspector for 1913 showed that in that year there were 302 men and 15 boys employed underground during the six months of that year the Fiddick colliery was operated. These figures do not take into account the months May to October, inclusive, when the miners were on strike.

The company has a newly opened mine, known as the Morden Shaft, situated about a mile away from the Fiddick mine, so that its output operations will not be entirely stopped, but there are not enough coal faces open in the new mine to allow of so many men being worked in it as have been employed in the older property.

LALLY GOLD MINES.

At the annual meeting of the shareholders of the Lally Gold Mines Company at the Windsor hotel, Montreal, the board and officers were elected as follows: President, G. H. Benson; vice-president, H. M. Levine; directors, W. L. Murray, R. H. Brand, W. Snow, J. Thurston Smith, M. L. Rose; secretary, John W. Evans; treasurer, M. Donnelly.

CALUMET AND HECLA.

The directors of Calumet and Hecla have declared a dividend of $5 per share. With the payment of this dividend stockholders will have received $124,750,000 in dividends since the formation of the company.

SPECIAL CORRESPONDENCE

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Power at Porcupine.—The scanty rainfall which has proved so serious a factor in entailing shortage of power and the closing down of mines in the Cobalt section has not caused any inconvenience in the Porcupine camp yet. As a matter of fact there was much more rainfall in the Mattagami basin above the height of land than to the south, and the two plants of the Northern Canada Power Company at Sandy Falls and Waiwaiten have not been so adversely affected. At the same time the power company thought the situation sufficiently serious to notify many of the mines that they might be obliged to cut off half the power at the beginning of March, and many mines have been storing coal for the possible emergency. The mild weather has made a slight change for the better; but while it thaws in the daytime it freezes at night, and very little moisture finds its way to the watercourses. It is quite possible that many companies may have to have recourse to their boilers before the spring thaw finally comes. As there was power trouble in Porcupine last year most of the companies are quite prepared for the change; but it will raise costs, necessarily.

McIntyre.—Very satisfactory to the management of the McIntyre is the underground development at the mine within the past month. The No. 5 vein across Pearl lake is showing up splendidly. At the 400 ft. level a diamond drill hole had already indicated that there was a good grade of ore and the management was therefore able to find the vein easily. When first discovered it showed 3 ft. of ore much above the average grade of the McIntyre. Now it has widened right across the face of the drift and drill holes put into the walls show that there is enrichment for 15 ft. of an average grade of $9. At the same time the level has been cut at No. 4 shaft at the 600 ft. level. Here there was a surprise in cutting a good body of ore in the station. It is 4½ ft. wide of a lower grade. It is the policy of the management to open up new levels with all possible speed. The shaft on No. 5 vein will be continued down to the 500 ft. level, and No. 4 will be put down again directly the drift is well under way at the 600 ft. Operating costs are showing a satisfactory falling off. Last month they were $4.77 a ton on a 150 ton basis, charging all costs against actual production. The milling costs are now below a dollar. The nature of the orebodies at the McIntyre makes a lot of dead work necessary and the mining costs are therefore still a very large proportion of the whole.

Vipond.—An addition is to be made to the Vipond mill whereby the capacity will be increased materially. The plant is now running very smoothly and a good extraction is being made.

Underground at the 300 and the 200 ft. levels the developments on the Davidson vein have been far better than could have been anticipated. The grade at the 300 ft. level is far higher than at the 200 ft. and the width is well maintained at the 200 ft. level, some very good ore is being stoped. This is all the more satisfactory, owing to the fact that when work was resumed the drift on the Davidson vein showed results not at all pleasing to the company. But this lean spot has now been traversed and the ore is quite spectacular.

Hollinger.—At the 800 ft. level of the Hollinger the lean patch in the main vein, which has always to be drilled through before the average grade is reached, has been traversed. The Hollinger always sinks a winze before making connection with the main shaft, and this winze is always in lean ore. But the drift at the 800 ft. level now shows in the face 4 ft. of ore of a character which could not be distinguished from that on the first level. As the tonnage of the mill is increased more and more, ore from minor veins can be included as profitable ore. These smaller veins are of lower grade than those that have furnished the bulk of the ore to date. It is this inclusion of smaller and less valuable orebodies that is gradually lowering the Hollinger average grade, rather than any falling off in gold values in the veins originally worked.

It is considered probable that the Hollinger and Acme will have 100 stamps falling early in March. Sixty of these will be dropping on Hollinger ore and 40 on Acme. It was at first intended that 80 should be on Hollinger and the 20 on Acme; but the demands of the Acme have so grown on development that it was deemed advisable to increase the earning from that privately owned property at once. The Hollinger mill can be speeded up to 900 tons a day without much difficulty, and for the immediate present this is considered enough.

Dome.—Measurement of ore reserves at the Dome mine by means of diamond drilling has been definitely abandoned, owing to the difficulty in obtaining vertical holes. Instead drill holes are being bored at intervals of 15 ft. from crosscuts that are being opened up from the main levels and a revaluation of the mine being made by this means. Costs are still showing a satisfactory decrease and tonnage a good increase. There is no immediate likelihood of a further extension of the mill.

Dome Lake.—An average of 90 tons a day is being milled at the Dome Lake, and an extraction of about 80 per cent. obtained. Good results have been obtained by handpicking on the bumping table, and on the belt in reducing the percentage of waste milled.

A rich shoot of ore has been opened up on the No. 3 vein at the 400 ft. level in the east drift. Across 16 in. the gold contents are very satisfactory. But veins are erratic in width and exceedingly difficult to follow, so that a large amount of exploration work is necessitated.

At the annual meeting of the company it was shown that the Dome Lake Mining Company owed the Hudson Bay company $79,000.

There has been some discussion as to the advisability of cyaniding the ore; but it was finally decided to endeavor to increase the capacity of the present mill rather than to raise the extraction by resorting to the chemical process of treatment.

Jupiter.—The Jupiter shaft has been allowed to fill up. It will be remembered that for some time after the McKinley-Darragh relinquished its option the old company kept the mine pumped out. But the cost was material and the mine has been allowed to fill up for the present.

COBALT AND SOUTH LORRAIN

Milling difficulties.—The mills are closing down in rotation, but not quite as to schedule. The soft weather has made no material difference to the situation, for although it thaws in the day it freezes at night.

The Northern customs mill and the Dominion Reduction have resumed operations, and as they are treating La Rose, Chambers-Ferland, Kerr Lake, Crown Reserve, Drummond Fraction and Caribou Cobalt ore there is activity in these properties as usual. The Cobalt Lake mill has also resumed after a two weeks' shut down. The Cobalt Reduction mill, serving the Townsite and the City of Cobalt, was closed down for a week. The high grade mill at the Nipissing has been closed down for the annual clean up, but the low grade mill has not ceased operations at all as yet. Water is so low in Sasaginaga lake that there is danger to the Buffalo, Coniagas and Northern Customs mill from this quarter.

The Trethewey mine has been closed down after running continuously for almost ten years. The immediate cause is the shortage of power. It was required that the mill should be closed down for a month, and the company has been running along on so narrow a margin of profit for the past four or five months that it was decided to cut down overhead expenses while the property was idle by discharging the staff and not reopening until the price of silver improved. There is still a considerable quantity of low grade ore in sight in the mine.

Right of Way.—It is reported that the Right of Way Mining Company will reopen the mine at Cobalt shortly if air can be obtained. The same holds good of the Shamrock, Mr. A. M. Bilsky being successful in raising money for the purpose of further exploration of the old prospect.

It is remarkable that since the Workmen's Compensation Act came into force there has not been one serious or fatal accident in the Northern Ontario mines. Some minor accidents have occurred and already the commission has been set some difficult problems to solve.

Prospecting.—As a preliminary to the discussion on the problem of keeping the prospector in the country, Mr. B. Neilly, president of the Cobalt branch of the Canadian Mining Institute, appeared before the Cobalt Board of Trade recently. He stated that whereas there were three thousand prospectors in the bush two or three years ago, he had it on the best authority that there were not more than 300 now. He appealed to the Cobalt Board of Trade to co-operate with the Canadian Mining Institute to get the law changed so that there would be more inducement for the prospector to stay in the bush and hunt for the precious metals.

Nipissing.—Nipissing has stopped work at the No. 64 shaft until such time as there is more power available. Before stopping work the company cut the station at the 1.000 ft. level.

BRITISH COLUMBIA

Renewed activity.—With the approach of spring preparations are being made for extending mining activity in several of the lode mining districts of the province. While no considerable enlargement of operations is being arranged for at any individual mine, a resumption of work at a number of properties indicates general endeavor toward progress. It is yet too early for much preliminary work to be done in the placer-gold fields. Where, though it is practicable to work to advantage even before the melting of the winter's snow, as in the case where underground work in lode mines can be effectively undertaken without much additional cost, some men are being employed on various properties that had been idle during a longer or shorter previous period. Among the parts thus affording evidence of renewing activity are Ainsworth, Slocan, Rossland, Boundary and Ashcroft division of Yale district. It may be that in each individual instance the number of additional men given employment is small, but taken together an appreciably large number is the encouraging result.

East Kootenay.

Metalliferous mines.—The only mine in Fort Steele division that during January and the early part of February shipped ore to the smeltery at Trail was the Consolidated Co.'s Sullivan property neary Marysville. For six weeks ended February 11, the average quantity received at the smelting works from this mine was 607 tons a week. At the St. Eugene, also owned by the Consolidated Co., ore shipment was suspended early in September; it is expected, though, that the prospecting work done latterly in this mine will result in other ore shoots being found.

Coal mines.—There is little that is new to chronicle relative to coal mining in the Crowsnest district. The demand for coke is being favorably affected by the increasing requirements of the Granby Consolidated Co., which has blown in more copper furnaces at Grand Forks, and railway coal requirements are stated to be larger, so these have also in a measure improved the local situation. The Crow's Nest Pass Coal Co. is operating mines at two of its collieries, namely, Coal Creek and Michel, and coke ovens at Fernie and Michel, but is not working full time at either colliery. The Corbin Coal and Coke Co. is also sending out coal and is looking for an improvement in the demand for this fuel.

West Kootenay.

Ainsworth.—Small shipments of ore have been made to Trail recently by four mines in this division, namely, the Charleston, J. L. Retallack & Co.'s Whitewater group and Utica, all in the western part of the division, and the Early Bird, on the western shore of Kootenay lake. A few men have been put to work at the No. 1 mine, at which operations had been suspended for a while; other properties within a few miles of the town of Ainsworth, on which development has been continued, are the Silver Hoard, Florence Silver Mining Co.'s Hope group, Olive A. group, and Gallagher. It is probable that the Consolidated Co., which also owns the No. 1, will shortly resume operations at its Banker-Maestro and Highland properties, all of which are within easy reach of a shipping wharf at Ainsworth.

Slocan.—Production has not yet been resumed to any considerable extent from mines in Slocan division, mine owners generally thinking it better to wait for the restoration of terms and conditions that will leave them more profit than they would be likely to receive under those in force last Autumn. Negotiations have been in progress with the object of securing the removal of a charge additional to rates previously paid, to which several of the silver-lead ore shippers have objected. It is stated that there is a probability of a satisfactory understanding being arrived at shortly. Meanwhile the higher price now obtainable for spelter is influencing mine owners having concentrating mills

available for operation in connection with their mines, and it is expected that if the advance in market price of that metal be maintained, the mining and milling of lead-zinc ore will be again undertaken at full capacity.

Slocan mines that have made shipments this year are comparatively few. Receipts of ore and concentrate at Trail from this division to February 12 were as follows: From Rambler-Cariboo 378 tons, Hewitt (Silverton Mines, Ltd.),, 64 tons, Idaho-Alamo 58 tons, Reco 32 tons, Mercury 17 tons; total 489 tons.

Shipments of zinc concentrates from Slocan mines to United States smelting works in January were, according to the Nelson Daily News, as follows: Surprise 600 tons, Rambler-Cariboo 88 tons and Hewitt (Silverton Mines, Ltd.) 119 tons. The Utica shipped 42 tons of zinc ore. The Slocan Record, New Denver, reports that 23 cars of concentrates from Surprise ore have been shipped from the Ivanhoe mill at Sandon to Newark, New Jersey.

Around Sandon development is being continued at a number of mines, among them the Payne, Ruth-Hope, Slocan Star, Noble Five group, and several others. Of the numerous properties tributary to Slocan lake towns the Standard, near Silverton, is the most notable; while no production is being made pending an adjustment of smeltery charges, development work of considerable importance is being done in this mine, and the quantity of ore available for extraction is now large, other shoots than those from which ore was being stoped when production was discontinued having been opened as progress has been made toward their development.

Nelson.—There is little change to note in mining conditions in the parts of Nelson division to which access is obtained from the west arm of Kootenay lake. To the southward, though, within a few miles of Salmo and in Sheep Creek camp, operations are being continued at a number of properties, four or five of which are productive. Lead ore has this year been shipped to Trail from Salmo from three neighboring mines, as follows: From the H.B. 326 tons, Emerald 270 tons, and Leadville 63 tons; the Queen mine has shipped 109 tons of gold concentrate and the Hope 40 tons of ore. Three other gold mines, namely, the Relief in Erie camp, the Dundee at Ymir and the Granite near Nelson, have each shipped a carload. Total receipts at Trail of ore and concentrate from Nelson division to February 12 is 863 tons.

Granite is being shipped from Three-mile Point, near the town of Nelson, to Cardston, south-western Alberta, for use in the erection of a temple for a Mormon community resident in that district. It is stated that between 350 and 400 railway carloads will be required for the structure, and it is expected that this will all be supplied from the neighborhood of Nelson.

Rossland.—Production is being continued on a comparatively large scale from Rossland mines, the output of which has exceeded an average of 7,000 tons a week during the six expired weeks for which figures are available. The total of 42,189 tons received at Trail does not include milling ore put through the Le Roi No. 2 Co.'s concentrator. The proportions of the several mines are as follows: Centre Star group 23,804 tons, Le Roi 16,834 tons, Josie group (Le Roi No. 2 Ltd.) 1,546 tons, Phoenix 5 tons. Both the Centre Star and Le Roi groups are owned and operated by the Consolidated Mining and Smelting Co. of Canada, Ltd. The Phoenix is a small mine situated in the South Belt of Rossland camp, on which lessees recently commenced work; another property to which attention is again being turned is the Blue Bird, of which the Rosalia Mining Co. lately granted a lease to a Spokane man, who is expected to shortly ship ore from it to Trail.

The report of the Le Roi No. 2 Co.'s Josie mine for December, sent by the company's managers at Rossland to London, has been received from England. It gives the following information: "Shipped to Trail 823 tons of ore and 68 tons of concentrate. The receipts from the smeltery were $9,648, being payment for 903 tons of ore, and $642, for 41 tons of concentrate; sundry receipts were $639; total receipts, $10,929. Estimated working costs for the corresponding period were as follows: Ore production, $5,000; milling, $500; development, $1,500; total $7,000."

Trail.—On January 30 a fire occurred in the roaster department of the Consolidated Mining and Smelting Co.'s smeltery. In a brief published account of the damage done the loss was placed at about $2,000.

The total quantity of ore and concentrate received at the smeltery during six weeks ended February 11 was 50,019 tons. Of this, 44,279 tons came from the company's own mines, namely, from the Sullivan group in East Kootenay 3,641 tons, and from Rossland 40,638 tons, of which 23,804 tons was from the Centre Star group and 16,834 tons from the Le Roi. Custom ores received totalled 5,740 tons, this quantity including 101 tons from mines in Ainsworth mining division, 549 tons from Slocan, 863 tons from Nelson division, 1,551 tons from Rossland, 152 tons from Boundary district, 17 tons from Lardeau, 8 tons from Yale district and 2,499 tons from the State of Washington.

Boundary.—In the early part of February two more blast furnaces were blown in at the Granby Consolidated Co.'s smeltery at Grand Forks, these bringing the total in blast up to six. It is thought probable the remaining two will also be in operation soon. The Grand Forks Gazette says: "Somewhat of an experiment is now being tried in the shipment of matte from the Granby Co.'s smeltery at Anyox, Observatory inlet, to the company's reduction works at Grand Forks, to be reduced to blister copper. By this system work will be facilitated at Anyox, while the matte will serve as a flux at the Grand Forks works. During the latter part of January a shipment of 1,300 tons of matte reached Grand Forks from Anyox, a shipment of 1,500 tons, will come about February 15, and a further shipment of 1,500 three weeks later."

Reports from Franklin camp, north fork of Kettle river, tell of much activity in that part of the Grand Forks mining division. While the Union is the only producing mine at the present time, ore is being developed on other properties. There are numbers of prospectors at work, and the outlook is more promising than for years past.

The statement is made in district newspapers that the British Columbia Portland Cement Co.'s manufacturing works and plant at East Princeton, Similkameen, will shortly be offered for sale, as the company is being wound up. It is stated further that the Inland Development Co., of which Mr. J. J. Warren is head, is regarded as a probable purchaser.

General Notes.

One of the resolutions passed at the annual meeting of the Nelson Conservative Association, held on Feb. 9, was as follows: "Resolved, that this association desires to urge upon the Dominion Government the great importance of immediate financial assistance toward the zinc smelting development and further experiments in Nelson B.C."

It has been announced from Spokane, Washington, that an ore testing department for the purpose of determining the constituents, value, and uses of ores, rocks and chemical deposits submitted from any part of the North-West has been organized as a new feature of the annual North-West Mining Convention arranged to be held in Spokane February 22 to 27.

NOVA SCOTIA

Coal Outputs.—Outputs have been very restricted since the opening of the year, and production for January was the lowest for many years past. The Glace Bay mines of the Dominion Coal Company produced 256,000 tons, compared with 348,000 in January, 1914, and this reduction may be taken as typical of the other operating companies.

The Cape Breton Coal, Iron and Railway Company closed down its Broughton colliery during January. This mine was yielding about two hundred tons per day. It has had a very chequered career, and it is not expected that the colliery will re-open until the financial situation improves.

The Dominion Coal Company temporarily discontinued work at No. 2 colliery, placing the men in No. 22 mine, the output of which has been increased about 50 per cent. No. 21 colliery will resume operations towards the opening of navigation.

The Acadia Coal Company is considering the method of recovering the Allan shaft after the recent explosion. The shafts have been sealed since about the middle of December, and analyses of the mine air seem to indicate that the fire, if one existed, is practically extinguished. If it is decided to recover the area presumably affected by the fire, the operations will probably be guided by the principle successfully followed in similar cases of bringing forward the ventilation in a series of air locks, thereby avoiding the access of oxygen to the fire area. In view of the possible necessity for exploration of the unventilated area and the use of oxygen apparatus in this connection, the Acadia Company is training men in the use of apparatus daily, and has brought the equipment to a very efficient state. The fact that the management is going about the recovery of the Allan shaft in such a methodical manner, and is preparing so thoroughly, should lead to successful operations when the time comes to carry them out.

THE EXPORT OF NICKEL MATTE.

Ottawa, Feb. 11.

Correspondence between the Canadian Government and the Acting High Commissioner in London regarding the measures taken to prevent Canadian nickel going to Germany, was brought down to-day by the Prime Minister.

Sir Robert wrote on November 20, forwarding a copy of the report of Mr. Graham Bell, financial comptroller of the Railway Department, who had acted for the Dominion Government in their arrangement with the International Nickel Company. On December 11, Sir George Perley cabled that the arrangement was considered by Sir Francis Hopwood, chairman of the sub-committee appointed for the purpose of curtailing the enemy's supplies, as perfectly satisfactory. In a subsequent letter Sir George spoke of the arrangement being submitted to Mr. Churchill. Mr. Bell's report was considered quite satisfactory. On December 23 Premier Borden cabled for confirmation of the opinion of the Imperial Government, as there had been complaints in the press of nickel reaching the enemy. Sir George Perley replied by cable that Sir Francis Hopwood assured him the British Government were quite satisfied with the arrangements made "and appreciate the steps you have taken to assist them in this important matter."

The correspondence closes with the following letter to Mr. Graham Bell from W. A. Bostwick, assistant to the president of the International Nickel Company, New York:

"The statement that the Krupps are interested in the International Nickel Company has again been shown in attached article from the Journal of Commerce. To our positive knowledge, the Krupps have absolutely no influence in the affairs of the International Nickel Company. Our list of stockholders of record show that only 158 shares of common and 263 shares of preferred stock are owned by stockholders residing in Germany and Austria. An examination of the list of stockholders of record is open to any one of our Canadian stockholders, and we should be glad to extend the opportunity of extending the same to you should you so desire. This constantly recurring statement of Krupps' ownership and influence in this company is becoming exceedingly annoying, and we trust that some means can be speedily found by which it can be definitely refuted."

The annual general meeting of the shareholders of the Intercolonial Coal Mining Company, Ltd., will be held at the office of the company, Room 413 Dominion Express building, Montreal, on Wednesday, the 3rd day of March, 1915, at noon.

Officials of steel companies are concerned over sudden advance of 50 per cent. in price of manganese following Germany's blockade against England, which it is feared may interrupt the shipping of that alloy to United States. A lot of 200 tons for Pittsburg steel makers a few days ago was sold at $100 a ton, delivered. Prior to this, manganese could be purchased in Baltimore at $68 a ton.

BOOK REVIEWS.

THE CYANIDE HANDBOOK—By J. E. Clennel, Second Edition, Revised and Enlarged—McGraw-Hill Book Co., 1915—Price $5.00—For sale by Book Department Canadian Mining Journal.

In this new edition of Mr. Clennel's authoritative work every effort has been made to bring the information on all important sections of the subject up to date. New sections deal with improved methods of crushing and grinding, hydraulic classification, filter-pressing, vacuum filtration, agitating and aerating devices, zinc and aluminum devices, etc.

MINING COSTS OF THE WORLD—By Edmond Norton Skinner and H. Robinson Plate—McGraw-Hill Book Co.—Price $5.00—For sale by Book Department Canadian Mining Journal.

This is a compilation of cost and other important data on the world's principal mines. It is a compilation of results obtained at the various properties. The figures are taken mainly from the companies' annual reports and financial statements and from the authors' personal notebooks. Accompanying the data are brief descriptions of the mines and methods. These descriptions are too brief to allow of intelligent comparisons of costs at several properties. However, to those who know the conditions the book will prove very useful.

ASBESTOS CORPORATION OF CANADA.

According to the third annual statement of the Asbestos Corporation of Canada the operating profit for 1914 was $343,236, showing a gain of $77,304. After increased expenditure on renewals and betterment and the creation of a special reserve of $40,000 for possible loss the year's surplus of $68,183 shows a gain of $13,-418. This brings the total surplus up to $191,031.

The balance sheet shows that the company has strengthened its position materially. The current assets increased by $71,332, while current liabilities fell off to the extent of $36,609.

The profit and loss account offers the following comparisons:

	1913.	1914.
Operating profit	$270,932	$343,236
Renewals, etc.	67,416	85,052
Special reserve	......	40,000
Bond interest	148,750	150,000
Total deduction	216,166	275,052
Surplus for year	54,765	68,183
Previous surplus	68,082	122,847
Total surplus	122,847	191,031

The chief features of the balance sheet afford the following comparisons:

Assets.

	1913.	1914.
Property account	$9,065,703	$9,062,122
Cash under trust deed..	40,140	41,261
Bonds in treasury	25,000	25,000
Inventories of asbestos, etc.	344,163	366,642
Accounts and bills receivable.	207,128	326,992
Cash.	524,390	453,379
	$10,216,502	$10,288,077

Liabilities.

	1913.	1914.
Preferred shares	$4,000,000	$4,000,000
Common shares	3,000,000	3,000,000
Bonds issued	3,000,000	3,000,000
Accounts payable	72,437	52,130
Accrued liabilities	5,010	3,101
Liabilities in suspense..	16,207	1,814
Special reserve	......	40,000
Surplus.	122,847	191,031
	$10,216,502	$10,288,077

The president, W. G. Ross, in reporting on behalf of the board to the shareholders says:

"The statement of profit and loss for the year shows a gross profit before providing for interest on the bonds and provision for renewals and betterments, etc., of $343,236.11, as compared with $270,932.37 for the previous year.

"The amount expended on additions and betterments to the property during the year amounted to $85,052.70 as compared with $67,416.78 expended during the previous year; and there has been provided in a special reserve account an amount of $40,000 for doubtful accounts.

"The properties of the company were operated throughout the year with the exception of the British Canadian property at Black Lake, which was closed down during the winter months. As mentioned in the last annual report, the production of this property has not been satisfactory owing to the small percentage of yield of asbestos, and while the reopening of the Standard pit has slightly improved the yield during the past summer, the mill results from this property are disappointing. In order to further explore the properties at this place your directors decided to tunnel from the present pits towards and under the old Manhattan pit; the driving of this tunnel will take at least one year, but when completed will not only have the object of prospecting your Black Lake property, but will prove the value of the Manhattan pit and if successful will allow of economical handling of the rock from this pit.

"The change in the hoisting and handling facilities at Kings pit have been further considered and studied, and your directors have decided to carry out the improvements during the summer of 1915 in order that the new plant may be put in operation early in the spring of 1916. The cost of this change involves an expenditure of approximately $200,000.

"In this connection before deciding to proceed with the new equipment your directors deemed it advisable to prospect the property immediately adjacent to the pit by diamond core drilling. This work was proceeded with throughout the year, the results of same being highly satisfactory. Two holes were drilled in the pit to a depth of 400 ft. below the present bottom, which showed equally as good material as that which had been extracted. Based on this depth, the territory prospected, which is only a comparatively small part of the company's property, showed a tonnage sufficient for over 40 years' operation.

"The machinery and plant of the company has been maintained and improved, owing to the disturbed conditions the development of the properties was curtailed during the latter half of the year.

"The company's office at Hamburg was perforce closed at the outbreak of hostilities and unsettled the business of the company, over one half of which was done in Germany and Austria, the effect of which will be felt more during the coming year. Your directors, however, hope for increased demand from England, and with the orders on hand from the United States that the results of the coming year, in spite of the unsettled conditions, should be fairly good under the circumstances.

"Your directors would call your attention to the strong financial position of the company, the advantage of which cannot be overestimated during such unusual and disturbing conditions. The tonnage produced was the same as last year. The unfilled orders on hand amount to $666,214.50.

C. M. I. WESTERN BRANCH MEETING.

The nineteenth general meeting of members of the Western Branch of the Canadian Mining Institute will be opened at Victoria, B.C., March 11, 1915, at 11 a.m.

At this meeting routine business will be transacted and several papers having particular reference to coal mining on the Coast, mine-rescue apparatus, first aid to the injured, and on other matters relating to the mining industry, will be read and discussed.

All members of the Canadian Mining Institute in good standing residing in British Columbia or the neighboring parts of the United States are, by virtue of such membership, also members of the Western Branch. Members are earnestly requested to make an effort to attend the ensuing meeting, and are cordially invited to contribute papers on matters relating to mining for reading at it; also to kindly notify the secretary that they will do so, if such be their intention.

Non-members will also be heartily welcome to attend, and to take part in the discussion of the papers submitted to the meeting.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

February 23, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	.27⅝	.28
British Copper	.00½	.01
Braden Copper	.06⅝	.06¾
California Oil	276.00	279.00
Chino Copper	.34	.35
Giroux Copper	.00½	.01
Green Can.	.24⅛	.25
Granby.	.66½	.67
Miami Copper	.18¼	.18½
Nevada Copper	.11⅞	.12⅛
Ohio Oil	131.00	133.00
Ray Cons. Copper	.16	.16¼
Standard Oil of N. Y.	189.00	191.00
Standard Oil of N. J.	386.00	389.00
Standard Oil (old)	1200.00	.....
Standard Oil (subs)	800.00	.....
Tonopah Mining	.06⅝	.06⅞
Tonopah Belmont	.03⅝	.03⅞
Tonopah Merger	.39	.41
Inspiration Copper	.18⅛	.18⅜
Goldfield Cons.	.01½	.01 9/16
Yukon Gold	.02⅜	.02⅝

Porcupine Stocks.

	Bid.	Ask
Apex.	.02	.02¾
Dome Extension	.06¾	.07¼
Dome Lake	.24½	.25½
Dome Mines	5.80	6.00
Foley O'Brien	.16	.20
Hollinger.	22.00	22.40
Jupiter.	.09¾	.10½
McIntyre.	.33½	.34
Moneta.	.02	...
Pearl Lake	.02	.02⅝
Porcupine Gold	.00¼	.00½
Imperial.	.01¾	.02
Preston East Dome	.01½	.02
Rea.	.12	.17
West Dome	.06	.09
Porcupine Crown	...	.83
Porcupine Vipond	.37½	.38

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.02¼	.02⅜
Beaver.	.27	.27½
Buffalo.	.70	1.00
Chambers Ferland	.12	.15
Coniagas.	4.75	5.00
Crown Reserve	.72	.77
Foster.	.02	...
Gifford.	.01	...
Gould.	.00⅜	.00½
Great Northern	.03¼	.04
Hargraves.	.01	.01¼
Hudson Bay	.20	.30
Kerr Lake	4.50	4.80
La Rose	.67	.73
McKinley.	.40	.43
Nipissing.	5.40	5.60
Peterson Lake	.22¾	.23
Right of Way	.03½	.03¾
Leaf.	.02½	.02¾
Silver Queen	.02	...
Temiskaming.	.17½	.17¾
Trethewey.	.10	.14
Wettlaufer.	.05	.06
Seneca Superior	1.00	1.50

TORONTO MARKETS.

Feb. 23—(Quotations from Canada Metal Co., Toronto.)
Spelter, 11 cents per lb.
Lead, 5¼ cents per lb.
Tin, 44 cents per lb.
Antimony, 21 cents per lb.
Copper, casting, 17 cents per lb.
Electrolytic, 17 cents per lb.
Ingot brass, yellow, 10; red, 12 cents per lb.

Feb. 23—(Quotations from Elias Rogers Co., Toronto.)
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

GENERAL MARKETS.

Feb. 19—Connellsville coke, (f.o.b. ovens).
Furnace coke, prompt, $1.55 per ton.
Foundry coke, prompt, $2.00 to $2.50 per ton.

Feb. 19—Tin, straits, 39.50 cents.
Copper, Prime Lake, 14.62 to 14.87½ cents.
Electrolytic copper, 14.55 to 14.65 cents.
Copper wire, 15.87½ cents.
Lead, 3.85 to 3.90 cents.
Spelter, 9.50 cents.
Sheet zinc, (f.o.b. smelter), 12.00 cents.
Antimony, Cookson's, 21.00 cents.
Aluminum, 19.00 to 19.50 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10 p.c., $47.00 per ounce.
Bismuth, $2.75 to $3.00 per ounce.
Quicksilver, $60.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
February—		
9.	48⅛	22 9/16
10.	48¼	22⅝
11.	48⅜	22 11/16
12.	....	22⅝
13.	48¼	22 11/16
15.	48½	22¾
16.	48⅜	22¾
17.	48⅝	22⅞
18.	48⅞	22 15/16
19.	48⅞	22⅞

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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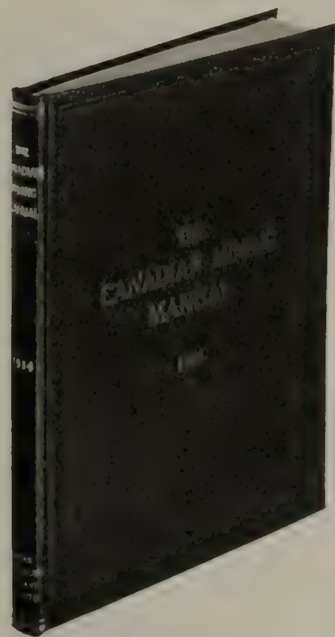

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This is a handbook of information concerning the mining industry in Canada.

The first part of the book gives general information concerning the chief minerals produced in the Dominion, and reviews by provinces.

The second part "Mining companies operating in Canada," gives useful information concerning location and character of properties, capitalization, officers, results of operations, etc. Companies are listed alphabetically and also according to product. This is an invaluable reference book for those who have machinery or supplies to sell to mining companies.

The book of 280 pages is well illustrated, printed on good paper, and bound in cloth. The price is $2.00 post paid. Shall we send you a copy?

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VOL. XXXVI

TORONTO

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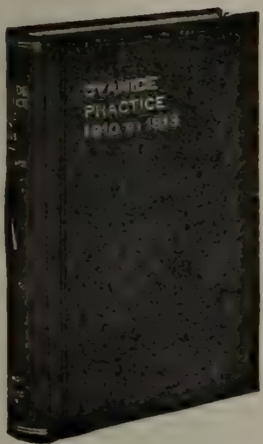

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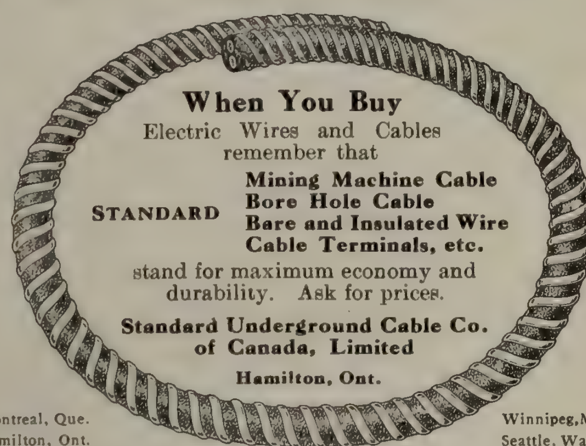

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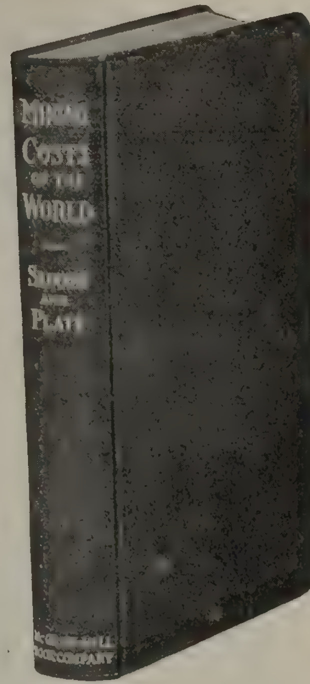

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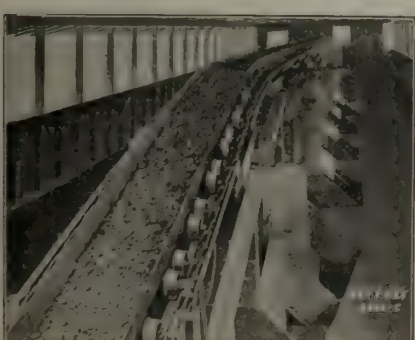

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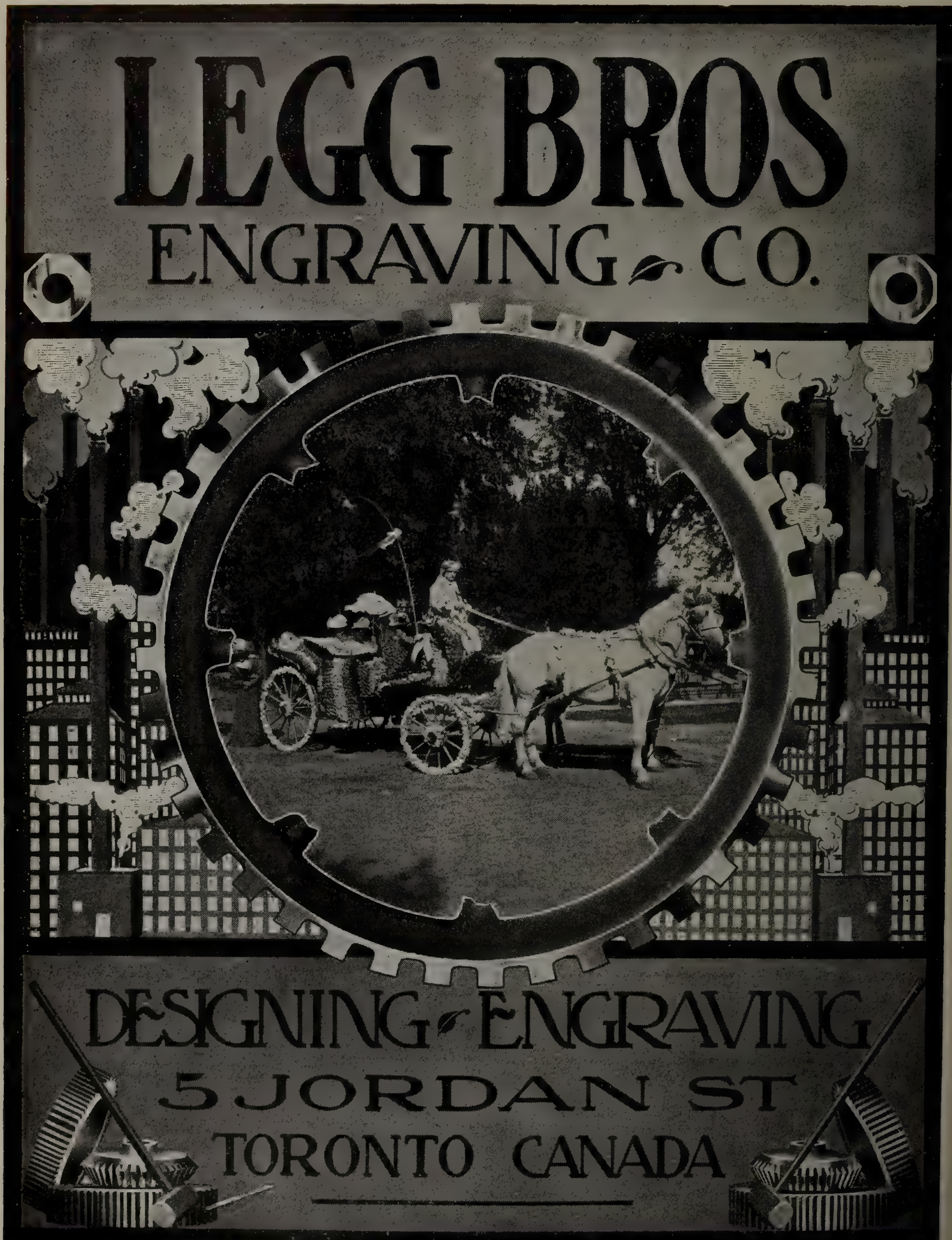
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VOL. XXXVI. TORONTO, March 15, 1915. No. 6

The Canadian Mining Journal

With which is incorporated the

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Editor
REGINALD E. HORE

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CIRCULATION.

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CONTENTS.

TAXATION OF MINING COMPANIES

In the Ontario Legislature last week, Mr. Sam Carter, member for South Wellington, moved for a return relating to the royalties and taxes paid by nickel companies operating in Ontario. According to the newspaper accounts of the discussion evoked by Mr. Carter's motion there appears to be, among those unfamiliar with the facts, a general belief that mining companies do not bear a fair share of the burden of taxation. The great success of the International Nickel company makes some of our members of Parliament envious. Some, claiming patriotic motives, ask for prohibition of export of nickel matte. Some, professing great faith in public ownership and showing an utter disregard for vested interests, ask that the Dominion and Imperial Governments take over the nickel business. Mr. Carter seems very much in favor of confiscation of the property of the Canadian Copper company. To such a proposition there is but one honorable reply.

The Mining Tax Act, providing for a three per cent. tax on profits over $10,000, came into force in 1907. In that year the Province received from this source $66,741.68; in 1908, $65,922.48; in 1909, $78,327.58; in 1910, $111,546.17; in 1911, $131,577.75; in 1912, $210,275.25; in 1913, $206,212.77, and in 1914, $201,940.20; a total of $1,075,273.54.

The contribution by companies in 1914 was as follows:

Beaver Consolidated Mines, Ltd.	$ 3,080.32
Buffalo Mines, Ltd.	5,957.70
Canadian Copper Co.	40,000.00
Casey Cobalt Silver Mining Co.	3,549.07
Cobalt Comet Mines, Ltd.	1,003.20
Cobalt Lake Mining Co.	3,287.63
Coniagas Mines, Ltd.	22,787.78
Dome Mines, Ltd.	7,335.59
Hollinger Gold Mines, Ltd.	28,787.39
Kerr Lake Mining Co.	15,067.68
La Rose Mines, Ltd.	18,919.14
McKinley-Darragh-Savage Mine	10,824.88
Mond Nickel Co.	4,000.00
Nipissing Mining Co.	25,691.06
Porcupine Crown Gold Mines, Ltd.	1,307.80
Seneca Superior Silver Mines, Ltd.	7,339.48
Temiskaming Mining Co.	1,535.63
Trethewey Silver Cobalt Mines	775.85
Wettlaufer Lorrain Silver Mines	690.00

The amount paid to the Provincial Government is by no means the only tax levied on the mining companies. The municipalities collect almost as much for local improvements.

While the tax to be levied on the silver mining companies can be rather easily determined, it is not such a simple matter to determine the tax on the nickel mining

companies. Most of the silver ore is sold to smelting companies and the actual value of the ore can be approximately fixed. On the other hand the nickel mining companies do not sell their ore. They smelt it themselves. The Mining Act provides for a tax on the value of the ore at the mines. The problem is to determine the value.

If the smelters were independent concerns buying ore in an open market the prices paid would decide the question. But the smelting of the ore and subsequent refining of the matte produced are of themselves large industries. Independent concerns would be expected to derive a profit from the work. Hence to the cost of smelting and refining must be added a reasonable amount for profit. Ontario has no right under the Act to tax the profit on the three industries; mining, smelting and refining. Hence it is obvious that the total profits of a company derived from the three sources cannot be taxed. The problem is to determine what proportion of the whole profit should be considered as derived from the mining of the ore.

This problem was carefully studied by the Department of Mines and it was decided to tax the Canadian Copper company at the rate of $40,000 for the three years 1912, 1913 and 1914. If to this be added $20,000 per year spent on local improvements, for the company bears all such expense, we arrive at a total of $60,000. In other words the Canadian Copper company is taxed three per cent. on an annual mining profit of $2,000,000.

The earnings of the International Nickel company for these three years averaged much above $2,000,000. For the year ending March 31, 1914, the company reported a profit of $4,792,664.75 in addition to $687,394.63 written off for mineral exhaustion. Some of the members of the Ontario Legislature are confusing these figures with the profits of the Canadian Copper company's mining operations.

In addition to the revenue from the three per cent. tax on profits of the above mentioned companies the Ontario Government has a large revenue in royalties from some of the Cobalt silver mining companies. Up to Oct. 31, 1914, the Government had received directly in royalties alone $1,836,049.84, most of which was paid by the O'Brien, Crown Reserve and Hudson Bay mining companies. In addition the Ontario Government Railway (T. & N. O.) Commission received $666,915.22, chiefly from the Cobalt Townsite, City of Cobalt and Right of Way mining companies.

THE GEOLOGIST'S WORK

In his excellent introduction of the discussion on "Stimulation of Prospecting," at the recent meeting of the Canadian Mining Institute, Professor H. E. T. Haultain suggested that the work of prospecting should be undertaken by the geologists. He says that the staff of the Geological Survey is large and that the survey might very well undertake to direct the efforts of the men without technical knowledge.

The idea that the number of government geologists is large enough for the undertaking of such work is one which Professor Haultain may have obtained by examination of the volume of reports issued annually. As a matter of fact the number of field geologists is so small that the areal mapping of the Dominion will take very many years, without giving the geologists new duties. Before loading them with new work, should we not wait until the work for which they are specially trained is finished? Why not leave prospecting to prospectors?

Geologists as a class are not prospectors. Some might make good ones and others certainly would be failures. Some are doing very useful work without having as good a knowledge of men and mining as the average prospector. A scientific knowledge of minerals and rocks may be useful to the prospector; but it is not essential. On the other hand a knowledge of mining matters, while desirable, is not essential to the geologist. He can make very useful maps without knowing how many ore deposits are in the area mapped. Of course the maps would be much more useful if all the ore deposits were marked; but the government geologist in this country must give his attention to the large features and map large areas. The critical examination of all outcrops is the proper task of the prospector.

If some geologists make good prospectors, is it owing to their scientific knowledge of rocks and minerals? To some extent it may be; but should we overlook the characters held in common by many successful prospectors and geologists, keenness of observation, an overwhelming desire to investigate and understand natural phenomena, a fondness for life in the open, physique which can successfully withstand the hardships of that life, and above all a mind determined on honestly and constantly searching and filled with the hope of making important discoveries and adding to their and the world's knowledge and wealth.

If added to such characters a man possesses a thorough training in the science of minerals and rocks, he may be expected to become a successful geologist. Denied such training, but given more actual experience with the prospector's pick, he might become a very successful prospector. Does the ability to detect and strip a mineral deposit and to determine its value depend so much on geological study as on experience in prospecting and familiarity with ore deposits being worked in various parts of the country?

Can we afford to have the geologists do the prospectors' work? If it can be done as well by men without special scientific training, why should we ask that the efforts of geologists be diverted from the enormous task of geologically mapping the Dominion? Who is to do the work of the geologist? Are we to urge scientific training on the prospectors so that they may be qualified to take up the work of mapping, while the geologists are demonstrating how to prospect?

DR. W. G. MILLER AWARDED I.M.M. MEDAL

The announcement of the award of the gold medal of the Institution of Mining and Metallurgy to W. G. Miller, Provincial Geologist of Ontario, will be received with great pleasure by his numerous friends. The medal is awarded only to men who have rendered eminent service to mining or allied professions. By his work as an economic geologist Dr. Miller has aided greatly the mining industry in Ontario. The citizens of Ontario should congratulate themselves that the Provincial Geologist is a man of such high calibre as to be chosen by the world's leading mining institution as the man most worthy of the highest distinction in its power to confer.

PUBLICATIONS OF THE MINES DEPARTMENT

We have heard it stated frequently that the Department of Mines, especially the Geological Survey branch, publishes too much; that the staff should be encouraged to devote more time to field work and research and less to writing books. Some of this criticism is hardly fair. The government employs specially trained men to make observations and conduct investigations. What for? Is it for the purpose of removing these men from useful occupations? Is it to give them congenial employment at the country's expense? We think not. The able members of the staff of the Mines Department are employed to make additions to our knowledge of the mineral resources of Canada. This they cannot do by exploration and investigation alone. To be useful to the public the results must be permanently recorded.

In a country like Canada where so much of the territory is unexplored it is obvious that the first duty of a survey is to make maps. Until the whole country has been topographically and geologically mapped this work may well occupy the best energies of the Geological Survey.

But the survey gathers much information of permanent value besides that used in map making. Reports on districts explored are surely useful publications.

While we cannot agree that the publication of reports should be discouraged, we are willing to agree that a change in classification and character of the publications is desirable. The numerous changes in the past ten years in the classification of publications have resulted in the production of a bewildering series of reports, memoirs, bulletins, handbooks, etc. An overindulgence in classification of the publications has resulted disastrously for the reader. The earlier system of annual volumes was much more satisfactory.

The voluminous character of some of the reports has led some critics to say that the authors have too much time to write. On the contrary, they seem to not have had enough. If more labor had been put on the writing, the reports might have been very much condensed. Much of the matter should never have been printed. Much of it should have been rewritten in briefer form.

The make-up of some of the recent reports indicates that the instructions to the printer were to make attractive looking books and not to worry about the reader or the cost. Thick rough paper on which half-tones cannot be reproduced is used for the text. The half-tones are segregated in the back of the book, where they cannot be conveniently referred to by anyone reading the text. The pages are given extremely wide margins, as though bulk were the chiefly desired end in printing. Both in reading matter and in make-up the reports are not what they should be.

CORRESPONDENCE

THE STIMULATION OF PROSPECTING.

Editor Canadian Mining Journal:

Sir,—It was with great interest I read, in the February bulletin of the Mining Institute, Professor Haultain's introduction to the subject entitled "Stimulation of Prospecting." Being myself an humble "knight of the pick," I am awaiting anxiously the publication of the papers and discussions on this very important subject, the hearing of which I was deprived of, owing to not being able to attend the annual meeting of the Mining Institute in Toronto.

In the meantime I would like to make a few remarks from the standpoint of a prospector, by way of expressing my opinion of some of the views held by the eminent gentlemen who discussed the subject in the March number of the Mining Institute bulletin. Right here let me say that I recognize fully enough the importance of the subject to realize that I am not offering a satisfactory solution, I may be permitted, however, to write a few words on a subject which I think should have the best thought and attention of every mining man in Canada.

In his paper, Professor Haultain describes the "good type prospector. He is a man in whose make up the element of hope has become predominant, and as years go by this feature becomes abnormal until it finally amounts to fanaticism. He is the real world's gambler, staking his all, civilization, family, comfort, friends, time, etc., against the chance of discovery. His grubstaking partners could trust him without the need of legal documents to bind the partnership."

These are certainly capital qualities and I believe that, if were added to these a knowledge of the rudiments of geology and mineralogy, the really necessary essentials of his calling, we would recognize in him the ideal type of prospector, and one who would be able to "deliver the goods."

To my mind, the prospector who is possessed of all these requirements is the man who must be depended upon to make the real discoveries of the future and although this type was not predominant in the Cobalt, Gowganda and Porcupine camps, yet, I believe there are still many of these men in Canada to-day, not forgetting some of the brave fellows who are now at the front, performing their assessment duties in "the trenches of the Empire."

In view of the above, my opinions are not entirely compatible with those of Mr. Lamb, who seems to think that the way out of the difficulty is to eliminate the old-timer and encourage, in his stead, the introduction of the professional mining engineer, as a prospector.

This policy would, undoubtedly, be a good one insofar as the taking up and working of old prospects or claims already staked, is concerned. But when it comes to exploring and prospecting new and inaccessible territory, the old type of prospector would come in, because, as Mr. J. McIntosh Bell states, in discussing the same subject, "There still seem to be men who love the free life of the woods and it is to them we must look for the discoveries of the future."

There are many young university graduates who do not particularly like this sort of life, and in addition, are not well suited for it. To my way of thinking, a man must love his work if he is to make a success of it, he must have his mind made up to overcome all the difficulties peculiar to his occupation and must not let such trivial matters as personal comfort, etc., interfere with his sensibilities. Some of the best woodsmen I have ever met were college men; but the average college man spends most of his life up to the time of graduating in at least comparative comfort and convenience, and when he finds himself suddenly deprived of these, and thrown upon a cold and unyielding nature, such as one invariably encounters in the business of prospecting, he is not perfectly equipped. His technical knowledge is abundant, but his practical knowledge, in some cases at least, is lamentably absent and, unless he has sufficient backbone to meet and combat the many obstacles which he is sure to encounter, he is apt to become a failure.

Some people seem to think that a practical experience in prospecting is unnecessary. But I have observed during my life time as a prospector and more particularly in the northern camps, that fifty per cent. of the men who go into the woods fail because of lack of effort or ability to apply it. On the other hand, as Mr. Lamb states, "it is reasonable to expect that scientifically directed effort in selected areas should be profitable." There should be no question about this, and, I believe, one good way to handle the matter would be to carry out Mr. Bell's suggestion that more reconnaissance parties should be sent out each year, headed by a geologist and with skilled prospectors attached to carry out the work. And this I think should be done in a detailed manner, that is to say, each party should be equipped with a small, but complete portable mining outfit, consisting of light mining tools, blacksmith's forge, dynamite, etc., using these tools to take the place of that much desired but still lacking "scientific instrument" of which Mr. Gwillim speaks, for seeing through brush, muck and overburden.

The objection to this form of prospecting would lie in the fact that any disposal of interests in discoveries thus made would be difficult. One way out of the difficulty would be to give each man employed a reasonable salary and interest, the Government retaining a certain percentage, or royalty, to reimburse itself for its part in the undertaking.

In the case of syndicates employing prospectors, I believe that more care should be exercised in the selection of men. In many cases the most important feature is the one in which most carelessness is exhibited, the selection of the prospector. To my mind the proper men to select are those possessing a knowledge of geology and mineralogy, who are willing to sacrifice personal comforts, friends, etc., who have a practical knowledge of the woods, camping, canoeing, the compass, etc., and above all who are honest and consistent in all their efforts.

Mr. Lamb further states that the decline of prospecting is traceable to the effects of wild-catting booms and all must agree with him. Why then, would it not be wise for the Government to draft legislation, requiring that only prospectors who can furnish certain qualifications and who will live up to them, be allowed miners' licenses in the event of another Cobalt or Porcupine being discovered?

Yours, etc.,

J. J. BYRNE.

Sault Ste. Marie, March 6, 1915.

CANADIAN MINING INSTITUTE ANNUAL MEETING

The seventeenth annual meeting of the Canadian Mining Institute, held in Toronto, March 3rd. 4th and 5th, was a distinct success. The attendance was not as large as at the 1912 meeting in Toronto; but the interest in discussions was keen and the attendance at the business session was larger than usual. The local committee in charge of arrangements for the annual meeting was composed of A. J. Young, Dr. W. G. Miller and Col. A. M. Hay.

At the opening of the session it was announced that Mr. G. G. S. Lindsey, president of the Institute, had been detained in England and would be unable to attend the meeting. Mr. A. A. Cole, vice-president of the Institute, presided.

Hon. G. Howard Ferguson, recently appointed Minister of Lands, Forests and Mines of Ontario, welcomed the members to Toronto. Mr. Ferguson referred to the fact that, next to agriculture, mining is the most important industry in Canada and that the responsibility of those directing the industry is great. He promised to do his best to further the industry in Ontario and in his work he hoped to have the support of the members of the Institute.

Amendments to By-laws.

The chief topic of discussion at the Wednesday morning session was proposed amendments to the by-laws. The amendments proposed by C. E. Smith and seconded by A. G. Burrows were designed to make representation in council proportional to the membership in various parts of the Dominion. The principle of representation according to membership found many supporters and few critics. There was however much opposition, organized by the Cobalt branch, to the amendments. The reason given for this opposition was that the present is not an opportune time to make any important change in Institute affairs as the meeting was not expected to be large. The large attendance and keen interest in the meeting practically nullified this contention.

The discussion was spirited and Mr. T. W. Gibson, who presided, was called upon frequently to decide points of order. A motion by A. A. Cole called for a twelve months' hoist of the discussion was put and lost. The discussion on the proposed amendments was then resumed. The motion was finally put and carried by a vote of 48 to 22.

The amendments provide that each Province (British Columbia including Yukon; Alberta including Saskatchewan and Manitoba; Nova Scotia including New Brunswick and Prince Edward Island) shall be represented in Council by a number of councillors proportional to the number of members entitled to vote in such Province. There is to be no change in method of electing the President and vice-presidents.

Mineral Statistics for 1914.

Statistics of mineral production for the Dominion of Canada and the Provinces of Ontario and Quebec were presented by John McLeish, Chief of the Division of Mineral Statistics, Mines Branch; Thos. W. Gibson, Deputy Minister of Lands, Forests and Mines, of Ontario; and Theo. Denis, Superintendent of Mines of Quebec. Elsewhere in this issue of the Journal the statistics are reprinted.

The Stimulation of Prospecting.

At the Wednesday afternoon session H. E. T. Haultain introduced a discussion on "The Stimulation of Prospecting." There was a lively interest displayed in the subject, for it is generally recognized that mining activity is based on the work of the pioneers and that recently these hardy woodsmen have been much less in evidence than they were a few years ago.

Mr. Haultain in introducing the subject referred to the peculiarities of the men who have made prospecting their life work. He spoke of them as men filled with a desire to make a big "stake" and willing to take a gambler's chance. In them hope is abnormally developed. They work in the face of hardships hoping that fortune will favor them sooner or later, and that they will be some day rich men. With these enthusiasts he contrasted the stakers of claims who have been so active in following up discoveries in Ontario.

Mr. Haultain suggested that an organized campaign in charge of geologists might have the desired results.

Other papers presented at the meeting were: Conservation of Our Mineral Resources, by Dr. Frank D. Adams, Montreal; Some Notes on Possible Effects of the Present European War on the Mineral Industry of Canada, by Robt. A. A. Johnston, Ottawa; Coal Tar Products and Artificial Dyestuff Industry, by L. O. P. Walsh, Sydney, N.S.; Safety Engineering at the Canadian Copper Company's Works and Mines, by E T. Corkill, Copper Cliff; Accident Prevention at Ontario Mines, by T. F. Sutherland, Toronto; Some Recent Developments in Metallurgy, by A. Stansfield, Montreal; The Oxygen Iron Torch, by David H. Browne, New York; The Hall Sulphur Process, by H. F. Wierum, New York; The Cottrell Process, by Walter A. Schmidt, Los Angeles; The Smelting of Titaniferous Iron Ores, by Bradley Stoughton, New York; The Economic Possibilities of the Yukon, by D. D Cairnes, Ottawa; Recent Developments in the Gold Dredging Industry in the Yukon, by O. B. Perry, New York; The Zinc Industry in America, by J. A. Van Mater, New York; The Recovery of Mercury from Residues of Amalgamated Cobalt Ores, by E. B. Thornhill, Cobalt; Miller Chlorine Process at the Royal Mint, Ottawa, by Ralph Pearson, Ottawa; Some Comparisons of Steam and Electric Hoisting Machinery, by J. B. Porter, Montreal; The Weedon or McDonald Mine, Weedon, Quebec, by L. D. Adams, Weedon; The Origin of Wabana Iron Ore, by Albert O. Hayes, Ottawa; Primary Cambrian Manganese Deposits of South-eastern Newfoundland, by Nelson C. Dale, Clinton, N. Y.; Gold on the North Saskatchewan River, by J. B. Tyrrell, Toronto; A New Gold Area in Northern Saskatchewan, by E. L. Bruce, Ottawa; The Ore Deposits of Copper Mountain, Similkameen, B.C. by Frederic Keffer, Greenwood, B.C.; The Ore Deposits of the Ainsworth Mining Camp, B.C., by S. J. Schofield, Ottawa; The Use of Potash in Agriculture, by R. Harcourt, Guelph; The Future of the Clay Products Industry in Eastern Canada, by Jos. Keele, Ottawa.

On Thursday evening the annual banquet was held. About 110 members and guests attended and a very enjoyable evening was spent. Col. Hay provided an excellent menu and Mr. Knight had arranged a musical program which was evidently much enjoyed.

There was no formal toast list. A number of guests and a few members were called on by Mr. Cole for short addresses. Hon. G. H. Ferguson, H. M. Tolmie, Bradley Stoughton, J. A. Van Mater, W. A. Schmidt, David H. Browne, H. E. T. Haultain, S. S. Fowler, A. J. Young and Col. Hay were among the speakers.

The results of the election of officers were: President, G. G. S. Lindsey; vice-presidents, Thos. Cantley and A. A. Cole; councillors, M. B. Baker, J. W. Bell, R. W. Brock, Theo. Denis, D. A. Dunlap, M. B. R. Gordon, A. J. Young, G. C. Mackenzie, D. H. McDougall and J. T. Stirling.

"FOES OF THINE OWN HOUSEHOLD"

"This war may yet prove a blessing rather than a curse if through it our people learn that the state is not something from which we are all to get as much as we can grab by the unscrupulous use of our votes, but represents rather ideals for which we are ready, if need be, to sacrifice our very lives."—Extract from Lord Robert's last article in the Hibbert Journal, October, 1914.

Who are the foes of Britain's race? What her
  statesmen's secret fear?
The Hohenzollern false, the senile Turk, the fierce
  Magyar?
Nay, for we fear not open foes. We dread the traitors
  in our midst,
Robbers of soldier's kits, hungering for gold though
  brave men die.

On Belgium's plain, 'midst Polish snows, hourly die
  Germania's sons,
Freely, gladly, proving full her measured boast that
  she breeds men.
Ruthless maybe, and cruel, but cowards, No! They
  have staked their all
Upon the dice of war, nothing have held back from
  Fatherland.

And we, whose pulses yet course blood of Nelson and
  of Drake,
Whose proud ancestry at Mons and Coronel was not
  bedimmed;
Have we given all? Or use we Britain's agony, this
  dread hour,
For private gain, raking deep for power the slime-
  beds of the vote?

The wine-crazed Hun, berserk with loathly lust and
  hate primeval,
We execrate, and shortly will we cleanse the tired
  earth of him.
Yet, with those who strive for party vantage and for
  gold compared,
This Teuton pagan shines a jewel bright from out the
  mire.

If but this scourge of War drive from the fair temple
  of our Race,
The foul money-changing brood, the leprous leeches of
  the polls,
Cleansing our nation's life. Then welcome we the grim
  Gods athirst.
Better the Valkyrie's shriek than the sweet slothful
  pipes of peace.

—F. W. Gray.

A TRIP TO GREAT SLAVE LAKE

By Gwynn G. Gibbins.

During the season of 1914 it was the writer's privilege to spend six months in that vast district of North-West Canada lying north of Athabasca Landing, particularly the district around Great Slave Lake.

As the trip is a rather unusual one it has been suggested to the writer that a short narrative, descriptive of the journey, might be of interest to fellow readers of the Journal.

Outfitting.—We outfitted at Athabasca, carefully checking over our supplies—a precaution not to be neglected if the voyageur looks forward to three square meals a day. We purchased a scow and loaded our provisions and camp outfits. These scows are made by the score each spring, and are 50 ft. long, 10 ft. wide and 3 ft. deep, and carry from five to eight tons. Our next, or rather our first real, difficulty was to engage a capable and reliable steersman. With the aid of the Hudson's Bay Company, this was finally done, though at an exorbitant cost, viz., $165 and grub both ways for the 265 mile journey between Athabasca and Fort McMurray.

Before starting we had to get numerous permits from the R.N.W.M.P., to wit: hunting license, permit to carry a gun, another for a hunting knife; but, above all, for permission to take in with us a bottle or two of Hennessy Three Star—for medicinal purposes only! By sad experience we found that this permission could only be granted by the Attorney-General for Alberta. Two of us spent a whole day in Edmonton fulfilling the required regulations. We found it was necessary to get a doctor's certificate from a doctor who knows one personally. Though all of us were strangers in Edmonton, this technicality was overcome by the payment of the inevitable fee, and we returned joyfully to the Government buildings, where we were again mulcted and granted leave to carry one gallon of liquor.

Shortly after noon on May 19th, our dreadnought and accompanying destroyer flotilla of eight canoes, manned by eighteen officers and seamen, fired the last salute and cast off—only to find that our steersman, David, had disappeared. We detailed parties to the various saloons and private rendezvous, but 'twas not till nearly 6 p.m. that we found him stowing away some kind of wood alcohol.

We cast off rather ignominiously on our long drift to the Arctic regions and barely reached the first bend when we ran aground and our steersman keeled over, dead to the world. Then we found and cast overboard his cache of several bottles of alcohol. Indians may not be served with liquor legally, so they drink anything at all containing an intoxicant, peruna, sarsaparilla, pain-killer, etc.—the latter being an especial favorite.

As there are no dangerous rapids for the first 100 miles north of Athabasca, we decided to continue, and accordingly set watches for the night—four hours on and eight hours off.

The "Flotilla" at Athabasca Landing, May, 1914

Method of navigating.—A few words here in reference to the modus operandi may not be out of place. The scow is fitted with six oars or "sweeps," made from small trees and each about 25 ft. long. The steering oar is a larger tree, about 35 to 45 ft. long, with a hole bored through it at a place not far from its point of balance, giving a leverage of about 15 ft. for the steersman. An iron post securely fastened to the stern of the scow passes through this hole, and this gives the steersman ample chance to wield the apparently clumsy oar. The Indians are remarkably adept at this work, and the best steersman can guide the scow, aided at intervals by the oars, with wonderful precision and skill through rapids seemingly impassable.

Towards the end of the following day our steersman had recovered sufficiently to be of material assistance to us.

Pelican gas well.—Early on Friday morning we reached the gas well of the Pelican Gas and Oil Com-

pany, situated on the east bank, about six miles above Pelican rapids. There was only a watchman on the property. The gas was burning, with a pressure of 7 lb. per square inch, and it has been piped to the buildings for cooking and heating purposes. Owing to the Calgary oil boom this summer, work was restarted, but no oil was struck. On our return in the fall we found the Government telegraph line had been constructed from Athabasca to this point.

Tracking up the Athabasca River

Government bore hole.—About a mile above the rapids, on the west bank, is the site of the Government bore hole, drilled many years ago to a depth of 800 ft. to tap the underlying Dakota Tar Sands. The pressure of gas was so excessive that the drillers were unable to proceed, nor were they able to cap the well, and the roar of the escaping gas could be heard for many miles. It is now well capped, but the pressure is still very great. The holdings of the Athabasca Oil Company are situated here, and during the past summer a very considerable amount of work was done, though apparently with no great success.

Grand Rapids.—The Pelican rapids were run without mishap, and we camped Friday evening at House River, about nine miles above Grand Rapids. From House River there is a very rough pack trail to Fort McMurray, used by the mail carrier, but almost impassable except in winter.

We had a hard time making the landing at Grand Rapids Island and still a harder time portaging our goods to the foot of the first rapids. The river falls over 50 ft. in less than 2,000 ft., forming a continuous cascade. These rapids are formed by the wearing away of the Grand Rapids sandstone, which is characterized by the number and size of silicious spherical concretions contained. These concretions, some 10 to 15 ft. in diameter, roll into the river and form obstructions over which the water falls.

Across the island the Hudson's Bay Company has built a narrow gauge railway, which pays no attention to grades or curves, consisting merely of rough wooden rails, upon which is tacked a strip of old iron. In some places there are ties, but almost as often not. It was built over twenty years ago—looks its age—and seems to be in a perennial state of collapse. It must pay handsomely upon the capital invested, as the charges are $2.50 per ton and $2.00 per canoe—you load the truck, haul across and unload yourself. The portage is less than 500 yards long, and as the duties of engineer, stoker, traffic and passenger agents, general manager and section gang are all performed by one man, perhaps this with the tariff schedule, explains why this railway is called the best paying in the world.

The Indians ran our unloaded scow down the east channel of the Grand Rapids. It was very exciting; several times she struck, but the water carried her over. At one place she struck very hard, went up in the air and came down with a terrific crash; but the steersman and his men hung to their posts and brought the scow through safely into the large back eddy just below the junction of the two channels.

From the lower end of the island, we then threw into the main or western channel a cordwood stick to which was tied a stout one-inch manilla rope about 600 ft. long. The current carried this stick into the back eddy and was picked up by the Indians on the scow. They fastened the end to the scow, and at a signal we all got into our tumplines by way of harness and pulled away until the scow reached the island. It was a very hard pull and, at times, though there were over a dozen of us on the line, no headway was made.

The scow was then loaded and our real thrills commenced. From here we had to run all but the two small canoes, which were taken up on the scow, through all the rapids. Two men were in each canoe, this left six men and our local Indian steersman on the scow. The Lower Grand rapids were very exciting; but luckily the water, though rough, was very deep. The Brulee rapids were easily run. Natural gas rises off Point Brulee, and we burned it in several places on the shore just above Little Buffalo river.

Boiler rapids, about 40 miles below Grand rapids, proved a stumbling block, and we had a very anxious time. Our scow struck and was whirled around but held fast.

The canoes immediately behind the scow had a hard time to escape being caught. However, we managed

Shooting Grand Rapids, May 1914

to land and tried to help. Two of our Sault Ste. Marie Indians, by very skilful work, got to the rock about 20 ft. above the scow. A rope from the stern of the scow was securely fastened to the rock, and then the boys in the scow pried and shoved. Suddenly she started and like a flash swung around. At the right moment, David, our steersman, cut the rope with an axe and the scow was off again. Meanwhile consternation spread on the scow because the water

was pouring in through a large hole. A canvas sheet and a couple of sacks of flour effectually stopped serious leakage until the boys were able to beach the scow above the rapids, where we made repairs.

The Middle rapids were very rough and exciting, but Long rapids and Crooked rapids were easily run. Rock rapids gave us a thrill when one of the canoes capsized. Luckily the boys got to shore safely.

At Boiler rapids the Dakota sandstones or Tar Sands were first seen, and gradually increase in thickness as we go north.

The Devonian limestone underlying uncomformably the Cretaceous Dakota sandstones first appeared just below the Crooked rapids. It lies nearly horizontal, with a dip of about 5 to 10 ft. south. Numerous fossils were seen, especially shells of the species "stromatoporoid." At Little Cascade rapid the limestone forms a ridge completely across the river, making a fall of about 2 ft. at low water. There was not quite sufficient water for our loaded scow, but we managed to get over without portaging. At Big Cascade we had a hard and laborious time. The drop here is about 4 to 5 ft. We had to portage every pound and then drag our scow over.

"Evinrudes," which we had brought purposely with us, we rigged them up on our scow and continued on our journey. We passed several deserted oil wells and the La Saline springs. The current is appreciably slower below McMurray, probably not averaging more than three miles per hour. We drifted by Fort McKay during the night, and only those of us on watch, the dog watch as it happened, saw the post. The last exposures of the Tar Sands were seen just below McKay. From here to Lake Athabasca all was drift.

Athabasca Lake.—With the aid of our Evinrudes we crossed the twelve miles of Athabasca lake at the mouth of the river, in about five hours against a fairly strong wind and reached Fort Chipewyan late on the evening of Wednesday, June 3rd, having drifted 450 miles from Athabasca.

Fort Chipewyan, to me, is the most picturesque and interesting of all the Hudson Bay posts to the north of Edmonton, at least south of Great Slave lake.

Both the Roman Catholics and the Church of England have large missions here, and in addition to the Hudson Bay Company there are several independent traders.

Portaging Across Grand Rapids Island

Mountain rapid gave us a little excitement because it is necessary to cross from the left bank to the right bank in a little space of comparative calm waters. If this crossing is made correctly, there is no danger, but if not, judging by the water, it would be a hard struggle to get through.

This is the last real rapid and we reached Fort McMurray about 5 p.m. on Wednesday, May 27th.

Fort McMurray.—A railway is being constructed between Edmonton and Fort McMurray, giving the place quite a real estate boom. Lots on the main street (by courtesy) are reported to have sold as high as $3,000 for a frontage of 25 ft. Fort McMurray, at the confluence of the Clearwater with the Athabasca rivers, was at one time a very important port. Before the railways were built across Canada all supplies used to go from Winnipeg by way of the Saskatchewan river, across portages to the Clearwater river, and down the Clearwater to Fort McMurray, which was the refitting point and terminus. From here all was comparatively easy. Now, however, so far as the Hudson Bay Company is concerned, it is merely a freight handling post, and practically no furs are traded.

Below McMurray.—After a stay of a couple of days, during which time we experimented with two small

Athabasca Lake abounds with whitefish and huge trout, sometimes 60 lb. in weight. We caught several over 40 lb. in our nets. The annual catch is about 900,000 lb., all for local consumption; dried fish being the chief food for the dogs in the winter time. There are two tribes of Indians here—the Chipewyans, who are industrious, hardy and in general prosperous, as compared with the Crees, a very inferior tribe, slovenly, improvident, careless and "white livered"—so called by the Chipewyans because they are afraid, or at least prefer not, to hunt far from home.

The remains of the old fort can still be plainly seen.

Geologically, at Chipewyan, Lake Athabasca cuts the western fringe of the great Archean shield, and from here north to Great Slake lake the rivers follow closely the contact between the Devonian limestones and the Archean gneissic rocks.

At Chipewyan our party broke up into several small groups, each group performing a certain duty. The writer continued northward, carrying all supplies in a 20 ft. chestnut canoe.

We left the Fort about 10 a.m. on Saturday, June 6th, and reached the Riviere du Rocher a few hours later. This river connects Athabasca lake with the mighty Peace river, and below the junction is called Great Slave. Riviere du Rocher is remarkable for the

Indian Party, Fort Resolution, 1914

fact that it changes the direction of its flow according as the Peace River is higher or lower than Athabasca lake.

Great Slave River is at times very rough, as we found out, especially as the prevailing winds in the spring are north.

We reached Smith Landing early in the evening of June 9th, after a miserable, monotonous, arduous journey of about ninety miles. All was excitement here owing to the arrival of the first scows of the season, which we passed a few miles above the landing. Every half-breed had a "permit," and cargoes were immediately broached and Bacchus reigned supreme, from the Hudson Bay factor down to the Indian with the smallest trickle of white blood in him.

The R.N.W.M.P. alone seem to remain steady and they had their hands full. We hired a team to take us across the 16 mile portage to Fort Smith, but in an hour our teamster was dead to the world. This portage is necessary because of the series of rapids between Smith Landing and Fort Smith. The river has here cut through a fringe of the Devonian limestone in a series of deep gorges and cascades. At Fort Smith the river is over 1½ miles wide and the townsite is on the plateau, probably 200 ft. above the river.

By the aid the R. N. W. M. P. and courtesy of the Hudson Bay Company at Fort Smith, we were fortunate in getting transported the following day.

Indian Dance, Fort Resolution, 1914

Fort Smith is an important Hudson Bay post, being the head office for the entire district to the north. The Northern Trading Company have a large post, while the Dominion Government Indian Agent is also located here. River steamers run from Fort Smith to the Arctic, a distance of over 1,500 miles.

The soil appears to be fertile and indeed it is expected that settlers will eventually locate along the rivers as far north as Fort Smith and westward. Fort Smith itself is just beyond the 60th parallel of North Latitude, and hence in the district of Mackenzie. The boundary line crosses the road to Smith Landing a couple of miles from Fort Smith. Navigation extends from about the first of June to the end of September.

We left Fort Smith on the evening of Thursday, June 11th, and arrived at Fort Resolution on Great Slave lake on the 16th, having had a couple of days very bad wind, which caused us to seek shelter.

(To be continued.)

INTERNATIONAL ENGINEERING CONGRESS, 1915, SEPT. 20-25, SAN FRANCISCO, CAL.

The technical success of the International Engineering Congress is now well assured. Notwithstanding the difficulties arising as a result of the present European war, the Committee on Papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some eighteen different countries. The Congress will therefore be truly international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned.

The Secretary, W. A. Cattell, announces that papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade.

The Committee of Management is now issuing to all important engineering societies invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured.

Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work.

The mineral products of the United States are discussed in a small volume now being distributed by the United States Geological Survey which contains a fund of useful information concerning the useful minerals and their values and production in all the States during 1912 and 1913. The figures given in some of the tables are so stupendous as to be beyond comprehension. In one table are given the figures for mineral production from 1880 to 1913, the metals being valued at $185,000,000 in 1880 and increasing to $883,000,000 in 1913. The non-metallic minerals increased $173,000,000 in 1880 to $1,562,000,000 in 1913, and the total mineral production from $365,000,000 to $2,446,000,000. This total for 1913 was an increase over 1912 of more than $200,000,000. The value of the metals imported for consumption in 1913 was $237,000,000 and of those exported $319,000,000. The value of the total mineral production from 1880 to 1913, inclusive, was $35,197,000,000.

DR. W. G. MILLER HONORED BY INSTITUTION OF MINING AND METALLURGY.

At a meeting held on Feb. 17 the Institution of Mining and Metallurgy, London, awarded its gold medal to Dr. Willet G. Miller, Provincial Geologist of Ontario "in recognition of the eminent services rendered to mining by his admirable work as an economic geologist." The medal will be presented at the annual meeting, Thursday, March 18.

In 1910, this medal was also awarded to Dr. R. W. Raymond, now secretary emeritus of the American Institute of Mining Engineers. The then vice-president of the Institution, Mr. Rawlinson T. Bayliss, in presenting the medal to Dr. Raymond, said: "I should like to add that the gold medal of the Institution of Mining and Metallurgy is the highest award which it has the power to bestow. It is not given indiscriminately; it is not confined to members of the Institution; it is not awarded for any specific, limited reason. It is, in fact, the 'order of merit' of the Institution of Mining and Metallurgy, and it is bestowed not necessarily upon mining men, but upon any man who, in any scientific profession, proves himself to be head and shoulders above his fellows, and who by his work and influence for good in the profession of which he is a member, has become entitled to this honor."

The Medal of the Institute of Mining and Metallurgy
From R. W. Raymond Presentation Book

At the centennial celebration of the Geological Society of London, the medal was given to Sir Archibald Geikie in recognition of the great services he had rendered to the science of geology; and, a year after, it was awarded to Dr. James Douglas, for his eminent services in mining and metallurgy.

Dr. Miller was born in Norfolk county, and is a graduate of the University of Toronto. He was professor of geology in Queen's University, Kingston, from 1893 to 1902. He has been connected with the Ontario Bureau of Mines since 1896, and was appointed Provincial Geologist in 1902. He was a member of the International Committee on Pre-Cambrian Nomenclature from 1902 to 1904.

Dr. Miller's field of labor has been largely in the geology of the pre-Cambrian rocks, particularly in Ontario. As these formations are pre-eminently the metal-bearing formations not only of Ontario, but also of Michigan and Minnesota, containing such well-known areas as Sudbury, Cobalt and Porcupine in this Province, and the great Mesabi, Vermilion, Gogebic, Marquette and other iron deposits as well as the copper deposits of Michigan, Dr. Miller's attention has necessarily been devoted to the practical and economic aspects of his work, as well as to the more purely scientific. He is recognized not only in Canada but also in the United States and Britain as one of the foremost authorities in the difficult field of pre-Cambrian geology, where fossiliferous means of identification are absent, and where the correlation of rock formations, perhaps widely distant, depends upon lithological, structural and other inorganic data.

The corundum belt of Eastern Ontario was examined by Dr. Miller in 1896, 1897 and 1898, and its relationships thoroughly worked out and established.

Even more brilliant was the work done by him at Cobalt. When silver was discovered there in 1903, he was the first geologist in the field and with his assistants in a remarkably short time deciphered and classified the rock formations, and his reports and geological maps have proven of the greatest possible assistance to miner and capitalist alike in the practical exploitation of the silver deposits. In volume 19, part 2, of the Bureau of Mines Reports, Dr. Miller has given a complete account of the geology and mineralogy of the Cobalt area, showing among other things the famous diabase sill, and its relations to the silver-bearing veins in the conglomerate and Keewatin.

Dr. Miller also investigated the pre-Cambrian formations of Eastern Ontario and showed, what had not been previously recognized, their parallelism to the corresponding series of northern and northwestern Ontario. The results of his observations were published in the 22nd report of the Bureau of Mines, part 2, under the title "The Pre-Cambrian Geology of Southeastern Ontario." Dr. Miller has also contributed freely to geological and mining publications, and is a past-president of the Canadian Mining Institute.

OPPORTUNITIES IN PATENTS*

By Stanley Lightfoot.

Some time ago a short article was published in this Journal relating to the patent situation as affected by the war, particularly referring to the opportunities presented to Canadian manufacturers by reason of the provision under the War Measures Act, 1914, for the avoidance of patents held by persons who are subjects of a state at war with His Majesty, and during the last few months it has been my pleasure to review the situation and note the general effect and increasing possibilities arising from the new conditions regarding enemy patents.

There has been, up to the present, a surprising lack of appreciation of these opportunities. Whilst many thousand inventions, some of extreme value, are patented in this country, there have been but few applications made for the avoidance of such patents, and for the granting of licenses to prospective manufacturers of the same, although I am advised that in Great Britain, in which country an act practically identical with our War Measures Act exists, there has been a marked movement of late towards the acquisition of licenses under these enemy patents with a resultant increase in business activity.

It is therefore my object to endeavor to indicate the reason of this apathy towards these patents which are subject to adoption. In order to do this, it is necessary to understand a matter which is not very often given much thought by the average patentee, he usually regards the granting of a patent as being merely something which he has bought and paid for, and that he has therefore fulfilled all his obligations with respect to the same. As a matter of fact, a patent is not granted merely in consideration of a fee. This franchise is

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conferred upon an individual as a reward for the benefits which he, himself, confers upon the public. It is, therefore, expected of the patentee that he shall commercially promote his invention to such an extent that these benefits will be actual as a result of the increase in commerce or production or the general advancement of trade by the use of the invention. Sec. 38 of our Patent Act accordingly provides that a patentee must commercially manufacture or work his invention within two years of the date of the patent grant, and in order that these requirements shall not be unreasonable, sec. 44 provides for exemption from the provisions of the first mentioned section where such manufacture cannot be profitably effected and articles held in stock owing to the particular nature of the invention.

Foreign inventors have, of course, to comply with one or other of these sections, and, owing to the present state of war, it will be readily understood that German and Austrian inventors will be unable to promote their inventions in the required manner, especially in view of the fact that they have not legal status in our courts. Prior to the outbreak of the war the usual method which has been adopted by foreign patentees has been to lease their rights in this country upon a royalty basis; but during the continuance of the war the payment of such royalties to the enemy is illegal and would ordinarily leave the patents open to a species of claim jumping owing to the inability of the patentee to obtain redress. This, however, is by no means the course which is advisable, either morally or otherwise, as upon the cessation of hostilities complicated situations as well as considerable friction would be bound to arise. This situation has been clearly foreseen and the introduction of the War Measures Act has not been, as many supposed, a form of reprisal upon enemy patentees; but on the contrary, as a form of protection to them as well as to our own inventors holding patents in the countries with which we are at war. This is an indication of good faith on our part for, as Section 14 of the British Patent Act, 1907, states in part "A patent sealed with the Seal of the Patent Office shall have the same effect as if it were sealed with the Great Seal of the United Kingdom." Where a patent is granted and the inventor has fulfilled all his obligations it is not the intention of the Government to treat these patents as if they did not exist, using the state of war as an excuse.

There can be no doubt that a great deal of the reluctance to take up the manufacture of these inventions is due to lack of knowledge as to the legal situations, and fear of losing capital in an enterprise which might not be protected against infringement proceedings at the termination of the war, or the possibility of competition arising as a result of others taking up these inventions. This is just what would actually occur had the annulment of enemy patents automatically come into force, as many imagined to be the case. The Government takes the responsibility, however, in granting the licenses upon such terms as it may deem to be fitting indemnity to the patentee, taking into full consideration the expense which the licensee will be put to. A further argument sometimes met with is that the licensee will find himself with possibly an expensive plant on his hands or a large quantity of unsold goods in stock upon the cessation of hostilities, and, owing to the patentee again coming into control of his patent rights, will be unable to dispose of same or continue to use his plant without consent of the inventor. This again is a mistaken notion as the duration of the license will be arranged to remain in force for a period extending beyond the cessation of hostilities to a sufficient degree as to ensure the licensee having reasonable opportunity to make a good return upon his investment. This is quite reasonable from the point of view of all parties when it is considered that the licensee has kept the patent before the public and has fulfilled the patentee's obligations.

It will be clearly seen that the granting of these licenses serves two purposes, one to take care of the patentee's interests and keep the invention before the public, and the other to serve the public and increase industrial activity. Accordingly in making application for the avoidance of a patent under the War Measures Act, a person may be actuated by a desire to better his own conditions as well as by a patriotic spirit, in benefiting commerce. By no means would this be construed as claim jumping or a desire to take advantage of a foreign inventor's inability to protect himself. That would not be in accordance with British spirit and respect for the seal of our patent office.

Whilst Austria is not a nation of inventors, Germany is decidedly a scientific nation and her subjects have produced a vast number of inventions which have materially added to the world's progress, many of these being patented in Canada. Perhaps the most important progress in German science has been in chemical research, resulting in the invention of processes involved in the production of many substances. Various structural devices have also been invented, whereby such processes are put into use. Considerable attention has also been given to various methods of tunnelling, well drilling, etc., and considerable space might be given to tabulating the many arts and manufactures which these patents cover. Probably the greatest German inventive activity has been in connection with the manufacture of, and various processes involved in dyeing, for which numerous patents are applied for every year by one of the large firms in Germany. There is no reason why the chemical industry should not be developed to a greater extent in Canada, and under the circumstances which at present exist, this country is in a position to undertake enterprises which have been practically unknown here previously. The public, however, seem to be extremely loth to take advantage of the opportunity which is knocking at their door, whilst they are bemoaning their fate as sufferers under present conditions. It is well to impress upon that class of the progressive community who are responsible for the furthering of industry, that these patents do exist, and that the profits of their production are to be had for the asking.

Procedure to Secure Licenses.

It is not to be considered that because comparatively few German inventions are widely known in this country, that is, along lines which especially appeal to the average reader of this journal, that such inventions are not protected. Every person is not acquainted with patents sufficiently to be able to see just where these opportunities lie, but it is not at all difficult to have a search made to ascertain just what patents have been issued to patentees at war with us, along such lines as the person may be interested in.

After deciding that a certain patent would repay one for the cost and trouble of manufacture, it is well as a precautionary measure to obtain an abstract of the case to ascertain what assignments, if any, have been registered, after which the application for avoidance should be made to the Commissioner of Patents, by means of a petition as prescribed in the Act. The acceptance of assignments which may be offered by an enemy patentee for what may appear to be an exceptionally reasonable sum, should be avoided as such assignments are liable to be declared invalid.

GOLD-BEARING GRAVELS OF BEAUCE COUNTY, QUEBEC*

By J. B. Tyrrell.

A short time ago I paid a visit to the alluvial gold fields on the tributaries of the Chaudiere river in Beauce County, Quebec, in company with A. O. Dufresne, late manager of the Champs d'Or Rigaud-Vaudreuil, and now Assistant to the Superintendent of Mines of the Province of Quebec. As the conditions under which the gold occurs in this district are not very generally known, and present some interesting features, a brief description of these conditions, and a consideration of the causes which gave rise to them, may be of interest to other mining engineers.

During the latter half of last century the country was visited by many mining engineers and geologists, and many references to it may be found in the reports of the Geological Survey of Canada between 1848 and 1911. The most important of these are by J. A. Dresser and J. Keele and the late Robert Chalmers. The Department of Colonization and Mines of the Provnce of Quebec also published a report with map on the district by J. Obalski.

From the earliest times the valley of the Chaudiere river formed one of the main avenues of approach to the St. Lawrence in the vicinity of Quebec from the country to the south as far as the seaboard of the States of Maine and Massachusetts. The Indians had a well-known trail along the banks of the stream, and armed troops and foraging parties constantly moved backward and forward along it between Quebec and New England in those insecure times before the ceding of Canada to Great Britain.

Discovery of Gold.

In 1823 or 1824, a woman first discovered gold in the Chaudiere Valley near the mouth of Gilbert river. No attention was paid to the discovery, but in 1834 a young girl named Clothilde Gilbert, taking a horse to water, found in the creek, close to the location of the previous discovery, a nugget of gold weighing 44 dwt. Eleven years later the DeLery family, owners of the seigniory of Rigaud-Vaudreuil, obtained a patent from the Crown giving them exclusive privileges forever to mine the precious metals within their seigniory.

In 1847, the year before gold was discovered in California, the Chaudiere Mining Co., which leased the mining rights from Mr. DeLery, mined gold on the Gilbert and Des Plantes rivers, and during the three following years continued to operate on the Gilbert river.

In 1851, the mining rights of the whole seigniory were leased to Dr. James Douglas and others of Quebec, who continued operations, chiefly on the Gilbert river, until 1864. After this date mining was prosecuted with more or less activity for about 30 years.

In all, up to the end of the century, about $2,000,000 worth of gold was extracted from the gravels of the Gilbert river valley, while it would seem that about $500,000 worth of gold was extracted from the gravel of the other tributaries of the Chaudiere river.

Character of Country.

That portion of the watershed of the Chaudiere river and its tributaries, from whose buried gravels gold to the value of $2,500,000 has been extracted, extends for twenty miles in the direction of the valley, and six miles transverse to it, forming a block of land about 120 square miles in area, in which placer mining has been more or less systematically prosecuted. It lies in Beauce County, Quebec, 50 miles southeast of the city of Quebec, and 25 miles west of the International Boundary Line between Quebec and the State of Maine. The principal town is Beauceville, with 1,700 inhabitants, situated on both banks of the river at an elevation of 500 ft. above the sea, with hills rising to heights of 600 or 700 ft. both to the northeast and southwest of it. Transportation to or from the district is afforded by the Quebec Central Railway, which at the present time runs two passenger trains a day each way to and from Quebec. The railway runs up the valley of the Chaudiere river through a number of small prosperous towns which are located on the bank of the stream, while back from the river the country is laid out in farms which are for the most part cleared of timber and in a good state of cultivation. Two wagon roads run up the valley, one on each side of the stream, and the method which has been generally adopted here, as elsewhere in Quebec, of surveying farms with a narrow frontage on the river and a long extension back from it, permits the farmers to live moderately close to one another beside the main roads, giving these roads the appearance of long-extended scattered villages.

The country in which the gold-bearing district is situated is a dissected plain or tableland with a mean elevation of 1,000 or 1,100 ft. above the sea, lying between two old and greatly degraded mountain ranges.

These mountains are the northern extensions of the Green Mountains of Vermont and the White Mountains of New Hampshire. They run in two parallel chains about 50 miles apart northeastward from the International Boundary into the Gaspe Peninsula. The stronger chain, which has been called the Megantic Range, runs along the International Boundary Line, and some of its peaks rise to heights of 2,500 or 3,000 ft. above the sea. Some of the peaks of the other chain, known as the Sutton Range, rise as high as those farther to the southeast, but taken as a whole this range is the lower of the two.

Between these two ranges of mountains lies an extensive tableland which has been worn down by long-continued atmospheric erosion into rounded hills and wide valleys. The summits of the hills are covered with a thin mantle of glacial drift, while the lower slopes are rounded up by a thicker layer of the same unassorted material. In their native condition the hills were completely covered by magnificent forests of pine and maple, now largely cut down since the land has been brought under cultivation.

Drainage.

The general direction of the drainage from this tableland is either northeastward or southwestward, parallel to the mountains. Nevertheless, it is trenched across, and the Sutton Mountains are cut through by the great transverse valley of the Chaudiere, which collects the water from the many normal longitudinal streams, and carries it down into the St. Lawrence river. This valley has been cut deep into the old plateau and has reached a fairly mature condition, with gentle slopes descending from the high lands on both sides to the river, which has a moderate and fairly regular grade of about 8 ft.

*Extracts from a paper presented at the New York Meeting of the American Institute of Mining Engineers, February, 1915.

to the mile from the upper portion of the area under consideration to the St. Lawrence river. Such minor obstructions as do occur in the stream, as at the Devils' rapids, have probably been caused by diversion of the river from its old channel by glacial agencies.

Structural Geology.

The rocks that compose the Sutton and Megantic mountains are pre-Cambrian gneisses, and talcose, chloritic, and micaceous schists.

Between these mountain ranges, in the region of the Chaudiere, the plateau country is underlain by green and reddish slates, quartzites, and sandstones, which are stated by the officers of the Geological Survey of Canada to be of Cambrian and Cambro-Silurian age. In many cases these slates, etc., present a remarkable similarity to the pre-Cambrian slates and schists of Keewatin age in northern and western Ontario. Some of the slates are ordinary water-worn sediments, while others have recently been proved to be ash rocks, or similar rocks of igneous origin.

These rocks were deposited in a horizontal attitude in the seas of the Paleozoic era, but have been squeezed and crushed so that they are now generally steeply inclined or even vertical, and strike about N. 45° E., parallel with the mountain ranges.

Through the schists and slates, dikes and bosses of igneous rock, varying in character from peridotite to quartz-porphyry, have been injected. It is highly probable that some of the igneous rocks intercalated with the slates were injected into them as sills or laccoliths before they were tilted and folded into their present attitude, but some of the dikes are doubtless subsequent to the folding. However, it is significant of the age of the igneous rocks associated with the gold-bearing gravels in the vicinity of Beauceville, that some of the green schists, associated with and included in the folding of the Cambro-Silurian rock in the valleys of Mill creek and Chaudiere river, were found to be volcanic rhyolite tuffs, while the igneous rocks in the vicinity are quartz-porphyries of similar composition, and probably of somewhat similar age.

In the valley of Gilbert river, from which most gold has been collected, quartz-porphyries and acid intrusives, either sills or dikes, are particularly abundant. In the vicinity of many of the more acid intrusives quartz veins have been found to occur containing more or less gold associated with such sulphides as pyrite, chalcopyrite and galena. These are all the hard rocks known to exist in the district under consideration, and such sediments as overlie them consist of unconsolidated material of very much younger age.

The oldest of the later sediments consist of thin beds of stratified gravel extending down the bottoms of the valleys, but of no considerable lateral extent. In places they contain grains and nuggets of gold. Overlying these gravels is a varying thickness, sometimes as much as 100 ft., of unassorted and unstratified boulder clay. Other and later sands and gravels also occur in gorges in the bottoms of the valleys, which also contain a small quantity of gold. Overlying these is a second thickness of boulder clay. Finally there is gravel in the bottoms of the present streams.

Historical Geology, Beauce County Gold Field.

The sequence of events which led up to the formation of these buried gold-bearing gravel deposits was about as follows:

After both the igneous and sedimentary rocks of early Paleozoic and pre-Paleozoic times had been formed or deposited and had been intensely crushed and folded into what must have been a range of mountains, they appear to have been intruded by dikes of the following igneous rocks: Peridotite, pyroxenite, gabbro and diabase, granite, quartz-porphyry, etc.

Subsequent to these intrusions, probably to the last of them, the rocks were again subjected to heavy strains, so that they were still further fractured. Into some of the more acid of the igneous rocks (whether dikes or sills is not always certain), siliceous waters carrying sulphides of iron and copper, with native gold, were introduced along the fractures, also from these fractures the gold-bearing solutions seeped out into the adjoining rocks, forming quartz veins and pyritized zones carrying a smaller or larger percentage of gold. Thus the veins were formed from which the grains and nuggets of gold found in the valley gravels have undoubtedly been derived.

Toward the close of the Paleozoic era, and after the rocks had assumed a fairly stable condition, the whole country was raised above the level of the sea, and since that time it would appear to have remained above sea level, and to have been exposed constantly to the influence of atmospheric and stream erosion and denudation. During this vast period of time, extending from the end of the Paleozoic era, to the present, an enormous thickness of rock was undoubtedly removed from the general surface, and as the softer rocks would be worn away faster than the harder ones, the latter remained as higher points and ridges.

At first the water which drained from the district would flow downward to the sea over the lowest parts of the surface, irrespective of the hardness of the rocks of which this surface was composed, and water courses so begun might persist to the present. The great valley of the Chaudiere is probably such a persistent water course, while the smaller streams have been cut off from their direct connection with the sea, and have been obliged to become tributary to the Chaudiere, their courses being finally determined by the varying characters of the underlying rock.

While the surface was being decomposed through the agencies of air and moisture, with the help of plants and animals, the decomposed rock was constantly being carried downward by the rills and streams, and at the same time was being assorted into heavier and lighter portions. In this process the coarser and heavier portions constantly lagged behind and became entrapped by the inequalities of the underlying rock, while the smaller and lighter portions were carried down into the main channel of the Chaudiere river, and thence into the sea.

In this way, during the long period which intervened between the uplift near the close of the Paleozoic era and the beginning of the Pleistocene period, the country was worn down, possibly from a high range of mountains, to a fairly mature physiographic relief, in which rocky cliffs and gorges were unknown, and the slopes of the hills were everywhere gentle, with coverings of decomposed residual rock. Also in the bottoms of the wide valleys the streams flowed with gentle regular current without rapids or waterfalls. In and beside these streams were deposits of sand and gravel which undoubtedly contained most of the heavy minerals that had been washed down from the adjoining hills during the whole period of their long-continued erosion, unless these minerals had been carried away in solution, or were in a sufficiently fine state of division to have been transported to the sea with the lighter sediments. Of

these heavy minerals the most important, and at the same time the most persistent, was gold.

The general relief of the country at the beginning of the Pleistocene period would have been very much like that of the Klondike district, in Yukon Territory, at present, particularly those parts of the Klondike drained by Dominion creek and Indian river, where later gorges have not been developed; with this difference, that the Quebec slopes were easier and the whole topography was more mature.

Another point of similarity between the two districts is, that throughout the whole time when active erosion was in progress the drainage of the country was local and the whole of the gravel concentrated in the bottom of any valley was derived from that particular valley or its tributaries, and not from a foreign valley.

Again, the gravel in the bottom of a valley was the ultimate concentrate from the vast quantity of material which had been eroded from that valley, possibly aggregating many cubic miles of rock, and consequently if the gravel was rich in gold it was due to the quantity of rock concentrated, rather than to the original high gold tenor of the rock.*

At the beginning of the Pleistocene period there was a break in the continuous course of atmospheric and stream erosion which had been in progress throughout the Mesozoic and Tertiary epochs, for snow and ice began to collect in great quantity on the Adirondack Mountains to the south, and from this center or gathering ground the ice moved northwestward down the valley of the Chaudiere river, across the hills which flank it on both sides, and over the valleys of the tributaries which flow into it approximately at right angles to its course, until it stopped in the vicinity of the south bank of the St. Lawrence river.

From the standpoint of the miner engaged in the exploitation of alluvial gold-bearing deposits, this first ice invasion from the south is of great interest, for, inasmuch as it moved down the Chaudiere valley, where this valley runs northwestward, it doubtless removed any stratified sand and gravel which may have been in the bottom of those portions of the valley so oriented, and at the same time it rounded up the sides of the valley, and filled in the mouths of the lateral valleys with debris collected from the valley itself or from the sides of the adjoining hills. During its later waning stages it probably also left lateral moraines on both sides of the valley.

When at its greatest extent, this Adirondack glacier covered the higher lands and moved over the valleys of the tributaries of the Chaudiere river which were transverse to its general course. In these cases it moved the decomposed rock from the summits and the south sides of the ridges down into the valleys and covered the gravel, which had previously been deposited there, with a coating of boulder clay or till.

In most cases, as in the valley of the Gilbert river, the glacier had lost the greater part of its pushing power when it reached the lower levels, so that it left the gravels undisturbed and merely covered them with its heavy coating of dirt brought from above. In some cases, as in some places on the banks of Meules creek, there was still a little vertical energy left in the glacier when it reached the bottom of the valley, and so it kneaded up the sand and gravel into a compact unstratified mass of water worn material a few feet in thickness before covering it with unassorted till.

While this northwestward moving glacier pushed a certain quantity of loose unassorted material into these smaller transverse valleys it did not fill them, but deposited its load on their southern slopes, and consequently when it retired it left the new bottoms of these valleys farther north than they were before, while the old pre-glacial gravels in the original bottoms of the valleys were buried under the talus of rock debris to the south.

When the Adirondack ice withdrew from the country at the close of the first glacial period, the brooks and rivers flowed in the same valleys which they had occupied before the ice invasion, but as the bottoms of the transverse valleys had been moved toward the northwest the streams naturally adopted the lowest parts of the valleys, and therefore now flowed in channels northwest of their former channels, and usually at somewhat higher elevation; at the same time they were cut off from the main Chaudiere valley by the ridges or lateral moraines which had been piled up along its sides. Consequently, in their endeavor to reach the main stream, the lateral brooks cut new gorges in the bottoms of the valleys northwest of the old channels, but their sides remained steep, for the period during which the country was free from ice does not appear to have been sufficiently long to have permitted of the grading of the sides of these second gorges to gradual slopes. One of these interglacial gorges has been outlined by shafts and drill holes on the northwest side of Meules creek.

After the deep, narrow, interglacial gorges had been formed the country was again, and probably more deeply, covered with ice, but on this occasion the ice accumulated on the Laurentian hills north of the St. Lawrence and then moved southward and southeastward across the St. Lawrence river and up the long slope south of it for about 100 miles almost to the summit of the Megantic range of mountains on the International Boundary line. This second invasion of ice therefore moved up the valley of the Chaudiere river in the opposite direction to that in which it had moved on the former occasion. Again it scored out and smoothed off the bottom and sides of the main valley. Also, as it passed over the valleys tributary to the main valley, and at right angles to its course, it pushed such decomposed and broken rock as it was able to collect down into these valleys, covering their

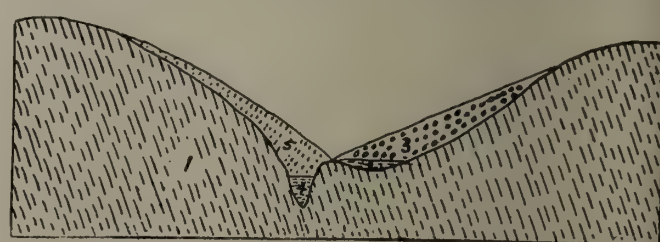

Fig. 1.—Diagrammatic Section Across the Valley of Meules Creek, Which Flows Northeastward into the Chaudiere River.
1.—Paleozoic slate.
2.—Pre-glacial gold-bearing gravel.
3.—Boulder clay of the Adirondack glacier from the southeast.
4.—Interglacial sand and gravel.
5.—Boulder clay of the Laurentian glacier from the northwest.

northern sides with debris and filling in and covering up the interglacial gorges which had recently been cut in them, but it did not completely fill the valleys with boulder clay, so that when this glacier in its turn melted away and disappeared, and open streams again began to drain the country, they flowed in channels independent of either of the earlier channels, and in some cases at least, intermediate between them.

Since the close of the last glacial period, when the ice finally retired from the country and left it in

*Cf. The Gold of the Klondike, by J. B. Tyrrell, Transactions of the Royal Society of Canada, vol. vi, New Series, Sect. 4, pp. 29 to 59 (1912), and The Law of the Paystreak in Placer Deposits, by J. B. Tyrrell, Transactions of the Institution of Mining and Metallurgy, vol. xxi, pp. 593 to 613 (1912).

much the same condition as it is at the present time, the streams in the transverse valleys are again cutting new channels for themselves in the bottoms of the valleys through the covering of clay and down into the underlying rock on lines indepedent of the earlier channels.

A striking feature of the new system of drainage which prevails in the country at the present time is that the lateral streams discharge into the main valley of the Chaudiere over rapids or waterfalls from "hanging valleys." This condition indicates clearly that the lower parts of these lateral streams are not now occupying their old pre-glacial or interglacial channels. In no case was I able to learn of either one or the other of the old channels having been traced all the way down into the Chaudiere channel.

When the ice had finally retired it left the whole country, both hills and valleys, covered with a sheet of glacial drift. On the hills this sheet is usually thin, while in some parts of the valleys it may reach a thickness of 100 feet.

This sketch of the causes which led to the formation of the beds of gold-bearing alluvial gravels, and of the methods which Nature adopted in giving them their present characteristics, and in hiding them in their present obscure locations, may be summarized as follows:

Summary of Gold Conditions, Beauce County, Quebec.

1. Gold was probably introduced into the folded Paleozoic rocks subsequent to, but in close association with, sills or dikes of acid rocks, such as quartz or granite-porphyry.

2. It was introduced along with pyrite and other sulphides in siliceous water which formed quartz veins in or near these dikes, etc.

3. Toward the close of the Paleozoic era the country was raised above the level of the sea, and has remained above the sea until the present time.

4. Throughout the most of this immensely long period, until the beginning of the Pleistocene period, it was constantly suffering erosion from atmospheric and stream agencies, and it was worn down to a fairly mature condition with gently sloping hills and wide valleys.

5. When gold occurred in these hills it had been washed down through countless ages into the bottoms of the valleys, and was concentrated in the alluvial gravels beneath and beside the streams.

Many streams throughout northern Canada which flowed over gold-bearing rocks must also have had gold-bearing gravel in their beds in pre-glacial times. In most cases, however, the subsequent glaciation was sufficiently severe to have carried away all this gravel, while in the Chaudiere district the glaciation was less severe, and some of the gravel was left in place.

6. After this long period of erosion and concentration a great glacier formed on the summit of the Adirondack Mountains and moved northwestward over the country toward the St. Lawrence river. On its way it crossed the valleys which lay transverse to its course, and buried some of the gravel which lay in the bottoms of those valleys under a heavy mantle of boulder clay. Sometimes the gravel was left quite undisturbed in its original condition, sometimes it was kneaded together so that its stratified character was obliterated. It is chiefly from these pre-glacial beds of gravel that gold has been extracted.

As the glacier moved directly down the Chaudiere valley it probably scored out most, if not all, of the gravel which had accumulated in it, though up to the present time this question does not appear to have been definitely settled, for the bottom of the valley has not been thoroughly prospected either by shafts or drill holes. At one place, namely at Devil's rapids, gold has been found in the Chaudiere river, but here the stream is flowing for a short distance transverse to the general direction of the valley and the course of glaciation.

7. After the Adirondack glacier had retired, new and narrow channels were cut by the transverse streams in the bottoms of the transverse valleys, to the north of the old pre-glacial channels. These contain a small quantity of gold, but the interglacial period was not sufficiently long to permit of the concentration of much gold in them, so that except where they may possibly have cut into or across the earlier pre-glacial channels they have not proved, and are not likely to prove, rich in gold content.

Up to the present time interglacial channels do not appear to have been distinguished from pre-glacial ones, and doubtless some of the failures which have occurred in the district have been caused by expending time and energy on the buried, but poor, interglacial channels, under the impression that they were the rich pre-glacial channels.

8. After the interglacial channels were formed another glacier advanced across the country from the northwest and buried these channels under another and later sheet of boulder clay.

9. When this glacier retired from the country the streams began to cut out their present channels, which are independent of the two former sets, but as yet no large quantity of gold has been concentrated into these new channels.

Whether all the buried gold-bearing gravels have been discovered or not will not be discussed here, but it may be pointed out that the pre-glacial channels of the lateral streams, which in their upper courses are gold-bearing, do not appear in a single case to have been traced down to their junctions with the main valley of the Chaudiere river, though it is reasonably certain, from the mature character of the topography throughout the country, that such channels are continuous without falls or interruption from the lateral valleys into the main valley.

Character of Bedrock.

The bedrock underlying the pre-glacial gold-bearing gravels consists chiefly of green and grey chloritic and quartzitic slates striking N. 45°E. and dipping southeastward at an angle of 70° or steeper. Where these slates are overlain by pre-glacial gravels they are rough and uneven and form excellent natural riffles, so that the gold was collected either in the inequalities of their surface, or immediately above them, and they have not been smoothed and polished by glacial agencies like the rocks of the adjoining hills.

On the Gilbert river and in other localities these slates were intruded by sills or dikes of quartz-porphyry, and these sills or dikes occur at places which are said to have been the most productive in the whole area; but in the absence of personal observation of the old mines it is impossible for me to say what effect the character of this bedrock had on the pay streak in the old channels.

Character of Gold.

The gold obtained from the gravels of the tributaries of the Chaudiere river is mostly such as is usually known to placer miners as coarse gold, very little

of it being in the form of very minute flakes or particles. There can be little doubt but that the fine gold existed in the veins from which the placer gold was originally derived, but if it did it was carried farther down the streams and much of it was probably deposited in the gravels of the Chaudiere river. One nugget was found on the Gilbert river which weighed 51 oz., 18 dwt., 6 grains, another weighed 45 oz., 12 dwt., while another nugget found on the same river weighed 42 oz.

Last summer Louis Matthieu recovered 50 oz. of gold from the gravels of Meules creek, all of which was quite coarse and granular. The largest nugget weighed between 2 and 3 oz., while the next largest, which I obtained, weighed 24 dwt., 12 grains.

Mr. Obalski gives the fineness of two samples of gold as 874 and 879, equal to a value of $18.06 to $18.15, and these may be considered as representing the average fineness of the gold of the district.

Methods of Mining.

In the earliest days of mining in the district the gravel was collected from the bars in the river, probably where the river crossed or cut into one of the old channels, and was washed in a gold pan or in a cradle or rocker to recover the gold.

Afterward some parts of the pre-glacial channels were discovered which were covered with but thin layers of boulder clay. The boulder clay was thrown to one side, and the underlying gravel was shoveled from the open pits into sluice boxes, supplied with water from higher up the river, and the gold was collected in the boxes.

At a later period the rich gravels were found under a heavy overburden of boulder clay, in places 60 or 70 ft. thick. In some cases this buried gravel was reached by tunnels driven into the sides of the hills, and in other cases by vertical shafts sunk to it. From the end of the tunnels and from the bottoms of the shafts as much of the gravel and underlying bedrock as contained gold was mined and brought to the surface, where it was washed in sluice boxes as before, and the gold extracted.

Four or five years ago a much more ambitious plant was installed on Meules creek. A ditch 7 miles long was dug from Lake Fortin, at the head of Mill creek, in which water was conducted to a penstock on the high ground south of Meules creek. Thence it was conducted in a pipe to a point on Meules creek where hydraulic operations had been determined upon, the head of the water at this point being 260 ft. Here one or more hydraulic giants were installed and through them the water was projected against the south side of the valley, and the gravel and debris were washed down and run through a sluice to collect the gold. At the tail of the sluice a bucket elevator picked up the tailings and stacked them lower down the valley. Unfortunately, the operations do not appear to have been financially successful, for the bank which it was proposed to wash down proved to consist of boulder clay, with but a thin layer of reassorted pre-glacial material beneath it, which was not sufficiently rich to compensate for the poverty of the boulder clay above. The plant has not been in operation for the past two summers.

During the past summer a few tributers or laymen were working in a small way "shovelling in" on Meules creek, with the result stated at the beginning of this paper, but mining work appears to have ceased on Gilbert, Des Plantes and other streams in the vicinity some years ago.

MINE FATALITIES IN BRITISH COLUMBIA.

A statement of coal and metal mine fatalities in British Columbia for the fourth quarter of 1914, compiled by Mr. Thomas Graham, Chief Inspector of Mines for the Province, has been printed and distributed. Reports received from the district inspectors of mines and from the operating mining companies show that during the quarter ended December 31 there were four fatalities in and around coal mines, but not any in or about the metal mines of the Province. During the corresponding period of 1913 there were four fatalities at coal mines and three at metalliferous mines. Taking the figures for the whole of the calendar year 1914, it is shown that there were 17 men killed in and about coal mines as compared with 27 in 1913, and 19 in and about metal mines, against 13 in 1913.

The coal mine fatalities in 1914 took place at the following collieries: Canadian Pacific Railway Co.'s Hosmer colliery, 3; Crow's Nest Pass Coal Co.'s Michel colliery, 1. and Coal Creek colliery, 3; Canadian Collieries (Dunsmuir), Ltd., Cumberland, Vancouver island, 6; Western Fuel Co.'s colliery, Nanaimo, Vancouver island, 4. The metalliferous mines at which lives were lost were: Rambler-Cariboo, Slocan, 1; Centre Star and War Eagle, Rossland, 1 each; Golden Horn, Ymir, 1; mines in Boundary district, Jewel-Denero, 2; Rawhide, 2; and Granby Co.'s mines, 5; Nickel plate, Similkameen, 1; Britannia, Howe Sound, 2; and Hidden Creek, in Skeena mining division, 3.

Causes of death were: At the coal mines, falls of roof and rock 2, falls of coal 1, mine cars and haulage 6, suffocation on fine coal 2, returning on unexploded shot 2, electricity 1, coke-oven larry 1, cage 1, falling off bucket 1; total 17. At metal mines, picking or drilling into unexploded powder 1, premature blasts 5, gassing or suffocation from powder fumes 3, falling in chutes or winzes 1, falls of ground 3, mine cars and haulage 1, returning on unexploded shot 1, slide of rock off quarry face 3, aerial tramway 1; total 19.

NEW JERSEY ZINC CO.

The real aristocrat among the American-owned zinc properties is the New Jersey Zinc Co. Its profits at the present time are little short of fabulous.

This company excels all others in the amount of spelter produced and marketed annually but owing to the closeness with which the stock is held nothing regarding earnings has ever come to light.

The company has been a big dividend payer for years having maintained a rate of $20 a share and paid extras in addition. In 1913 three "extras" of $10 each were paid making $50 for the year. Capital stock is $10,000,000; bonds $4,000,000. The last known sale of the stock was last fall at $525 a share. Current quotations range from $550 bid to $590 asked.

Last year the New Jersey Co. produced approximately 100,000 tons of spelter of a total of 349,000 tons in the whole country.

The company's Franklin Furnace mines in New Jersey yield the highest grade spelter in existence, this brand being marketed as "Horsehead." It always commands the highest premium over the prime western grades, being now quoted at about 18 cents a pound.

The New Jersey Zinc Co. does not, however, confine its operations to spelter alone for it produces as well sulphuric acid and other by-products. Not only does the company own and operate mines, but it buys ores and concentrates for smelting. It recently imported 10,000 tons of concentrates from Australia.—Boston News Bureau.

PRELIMINARY REPORT OF THE MINERAL PRODUCTION OF CANADA, 1914

By John McLeish, Chief of the Division of Mineral Resources and Statistics.

The preliminary report on the mineral production of Canada in 1914 presented herein shows a total value of the production during the year just closed of $128,475,-499. The total value of the production in 1913 was $145,634,812 compared with which the 1914 output shows a decrease of $17,159,313 or 11.8 per cent. The average production per capita was $15.91 as against $18.77 in 1913; $18.27 in 1912, and $14.93 in 1910.

The production of the more important metals and minerals is shown in the following tabulated statement in which the figures are given for the two years 1913 and 1914 in comparative form.

	1913.		1914.	
	Quantity	Value	Quantity	Value
Copper, lbs.	76,976,925	$11,753,606	75,738,386	$10,301,935
Gold, ozs.	802,973	16,598,923	770,374	15,925,044
*Pig iron, tons	1,128,967	16,540,012	783,164	10,002,856
Lead, lbs.	37,662,703	1,754,705	36,337,765	1,627,568
Nickel, lbs.	49,676,772	14,903,032	45,517,937	13,655,381
Silver, oz.	31,845,803	19,040,924	27,544,231	15,097,269
Other metallic pro.	....	1,313,732	....	1,123,919
Total.	....	81,904,934	....	67,733,972
Less pig iron credited to imported ores, tons	1,055,459	15,543,583	687,420	8,863,944
Total metallic ..	....	66,361,351		58,870,028
Asbestos and Asbestic, tons	161,086	3,849,925	117,573	2,909,806
Coal, tons	15,012,178	37,334,940	13,594,984	33,433,108
Gypsum, tons	636,370	1,447,739	510.663	1,137,157
Natural gas, M. ft.	20,477,838	3,309,381	21,047,028	3,511.302
Petroleum, bbls. ..	228.080	406,439	214,805	343.124
Pyrites, tons	158.566	521,181	224,958	735,514
Salt, tons	100,791	491,280	107,038	493.648
Cement, bbls.	8,658,805	11,019,418	7,172,480	9,187,924
Clay products	....	9,504,314	....	7,090,898
Lime, bush.	7,558,484	1,609,398	6,245,189	1,247,517
Stone.	....	5,504,639	....	5,593,485
Mis. non-metallic..	....	4,274,807	....	3,921,988
Total non-metallic		79,273,461		69,605,471
Grand total		145.634.812		128,475,499

*Short tons throughout.

In presenting a total valuation of the mineral production as is here given, it should be explained that the production of the metals copper, gold, lead, nickel and silver is given as far as possible on the basis of the quantities of metals recovered in smelters in Canada, or probably recovered from ores exported, and the total quantities in each case are valued at the average market price of the refined metal in a generally recognized market.

The quantities thus given will differ from those which represent metal contents of ore shipped by amounts due (1) to losses in smelting (2) to the "lag" or lapse of time between the ore shipment and its treatment in the smelter. Thus the production of refined lead during the past two years has been very much lower than that reported as contained in ores shipped from the mines, the difference being due both to smelter losses and the large accumulation of ore at the smelter.

The metal miner is usually paid for his product on the basis of the value of the refined metals less a variety of deductions and in many cases it would be exceedingly difficult to obtain a record of the net value received. It is for this reason and for the facility of comparisons that the refined values are used.

It will be observed that there has been a general falling off in the production of nearly all mine products, the notable exceptions being, pyrites, salt, and natural gas. In the case of pyrites there is an increase of about 42 per cent, and about 6 per cent in quantity of salt produced. The number of cu. ft. of natural gas produced shows an increase of about 3 per cent, with an increase of over 6 per cent in value.

The falling off in the production of the metals is no doubt to be ascribed in large measure to the conditions resulting from the war. Especially is this true in the case of the metals: copper, nickel, and silver. The cutting off of markets and the closing of metal exchanges with the consequent cessation of market quotations resulted in the almost immediate closing down or restriction of operation at many properties. However, before the close of the year, many of these adverse conditions had been adjusted although prices had fallen considerably.

The actual quantities of copper and lead produced were but little less than in the previous year; nickel showed a decrease of 8 per cent, and silver of 13.5 per cent in quantity.

The total values, because of lower prices, showed much larger percentage decreases.

The iron industry was undoubtedly affected by industrial conditions of depression and shows a falling off of 30 per cent in tonnage of pig iron made.

The total value of the metallic production in 1914 was $58,870,028 as against $66,361,351, a decrease of $7,491,323 or 11 per cent.

The production of non-metallic products also shows a large falling off in 1914, the total value for the year being $69,605,471 as against $79,273,461 in 1913, a decrease of $9,667,990 or 12.19 per cent.

The decrease is most pronounced in the case of coal, asbestos and gypsum and in those products such as cement, clay products (building brick, sewer pipe, etc.) and lime, generally classed as structural materials, although there was a small increase in the production of stone quarries.

Industrial depression the culmination of over development and extravagant land speculation is largely responsible for this sudden reverse although the asbestos output would be restricted by the disturbance in foreign markets and the coal production would also be affected by the restricted metallurgical operations. Reference has already been made to the increased production of pyrites, salt and natural gas.

There were also slight increases in the production of white arsenic, feldspar, grindstones, ochres, phosphate and tripolite. Asbestos shows a decrease of 27 per cent in tonnage and 24 per cent in value, coal a decrease of 10 per cent. in tonnage and 9 per cent. in value, petroleum a decrease of 5.8 per cent. in quantity and 15.6 per cent in value, clay products 25 per cent in total value and lime 17.4 per cent in quantity and 22.5 per cent in value.

Mineral Production By Provinces 1913 and 1914.

	1913. Value of Production.	1914. Value of Production.
Nova Scotia	$19,376,183	$17,514,786
New Brunswick	1,102,613	1,034,706
Quebec.	13,475,534	12,259,637
Ontario.	59,167,749	52,147,973
Manitoba.	2,214,496	2,428,902
Saskatchewan.	881,142	710,840
Alberta.	15,054,046	12,773,669
British Columbia	28,086,312	24,202,924
Yukon.	6,276,737	5,402,062
Dominion.	145,634,812	128,475,499

The record of production by provinces given in the above table shows the relative importance of the several provinces in the same order as the previous year. A decreased production is shown in each province with the exception of Manitoba and in this case the increase is due chiefly to the operation of the new cement mill near Winnipeg by the Canada Cement Co. and the inclusion of a more complete record of the production of sands and gravels. Ontario again has the largest output with a value of $52,147,973, or 40.59 per cent of the total, practically the same proportion as in the previous year. British Columbia is second with a value of $24,202,924 or 18.8 per cent of the total; Nova Scotia is third with a production valued at $17,514,786, or 13.6 per cent; Alberta fourth with $12,773,669 or 9.94 per cent; Quebec fifth with $12,259,637, or 9.5 per cent., Yukon sixth with $5.402,062 or 4.2 per cent; Manitoba seventh with $2,428,902 or 1.89 per cent; New Brunswick eighth with $1,034,706 and Sasketchewan ninth with $710,840, each less than one per cent.

Annual Mineral Production in Canada Since 1903.

	Value of production.	Value per capita.
1903	$61,740,513	$10.83
1904	60,082,771	10.27
1905	69,078,999	11.49
1906	79,286,697	12.81
1907	86,865,202	13.75
1908	85,557,101	13.16
1909	91,831,441	13.70
1910	106,823,623	14.93
1911	103,220,994	14.42
1912	135,048,296	18.27
1913	145,634,812	18.77
1914	128,475,499	15.91

The Mineral Production of Canada in 1914.

Subject to Revision.

Product.	Quantity.	Value.
Metallic.		
Copper, value at 13.602 cents per lb., lbs.	75,738,386	$10,301,935
Gold, ozs.	770,374	15,925,044
*Pig iron from Canadian ore, tons	95,744	1,138,912
*Iron ore sold for export, tons	60,410	135,300
Lead, value at 4.479c. per lb., lbs.	36,337,765	1,627,568
Nickel, value at 30c. per lb., lbs.	45,517,937	13,655,381
Silver, value at 54.811c. per oz., ozs.	27,544,231	15,097,269
Cobalt and nickel oxides, lbs.	1,387,101	595,999
Cobalt material and residues	....	82,620
Zinc ore, tons	13,140	310,000
Total.	....	58,870,028
Non-Metallic.		
Actinolite, tons	119	1,304
Arsenic, white, tons	1,737	104,015
Asbestos, tons	96,542	2,892,266
Asbestic, tons	21,031	17,540
Chromite, tons	136	1,210
Coal, tons	13,594,984	33,433,108
Corundum, tons	548	72,176
Feldspar, tons	18,060	70,824
Graphite, tons	1,647	107,203
Grindstones, tons	4,078	54,497
Gypsum, tons	510,663	1,137,157
Magnesite, tons	358	2,240
Manganese, tons	28	1,120
Mica, tons	....	102,315
Mineral pigments—		
Barytes, tons	612	6,129
Ochres, tons	5,890	51,725
Mineral water	....	122,574
Natural gas, M. cu. ft.	21,047,028	3,511,302
Peat, tons	685	2,470
Petroleum, bbls.	214,805	343,124
Phosphate, tons	954	7,275
Pyrites, tons	224,956	735,514
Quartz, tons	54,148	83,583
Salt, tons	107,038	493,648
Talc, tons	10,808	40,418
Tripolite, tons	650	13,000
Total.	....	43,407,737
Structural Materials and Clay Products.		
Cement, Portland, bbls.	7,172,480	9,187,924
Clay products—		
Brick, common, pressed, paving	....	4,809,046
Sewerpipe.	....	1,102,100
Fireclay, drain tile, pottery, etc.	....	1,169,752
Kaolin, tons	1,000	10,000
Lime, bush.	6,245,189	1,247,517
Sand and gravel	....	2,448,738
Sand-lime brick	....	624,335
Slate, sq.	1,075	4,837
Stone—		
Granite.	....	2,179,930
Limestone.	....	2,730,438
Marble (not complete)	....	192,533
Sandstone.	....	490,584
Total structural materials and clay products.	....	26,197,734
All other non-metallic	....	43,407,737
Total value, metallic	....	58,870,028
Grand total, 1914	....	128,475,499

*Tons of 2,000 lbs.

Metal Prices.

	1913. Cents.	1914. Cents.
Copper, New York	15.269	13.602
Lead, New York	4.370	3.862
Lead, London	4.072	4.146
Lead, Montreal	4.659	4.479
Nickel, New York	40.000	40.000
Silver, New York	59.791	54.811
Spelter, New York	5.648	5.213
Tin, New York	44.252	34.301

Smelter Production.

Statistics of the production of copper, lead, and silver smelters and refineries, showing the tonnage of ore treated, the matte, blister, base bullion, or refined metal produced, have been collected by the Mines Branch since 1908.

The total quantity of ores and concentrates treated in three smelters during 1914 was 2,649,935 tons (including 58,894 tons of imported ore), as compared with 3,037,391 tons in 1913. The largest proportion of the total tonnage, about 61 per cent. in 1914, consists of the copper-gold silver ores of British Columbia, chiefly from the Boundary (Phoenix and Greenwood), Rossland and Coast (Britannia, Texada Island and Granby Bay) districts. The nickel-copper ores of the Sudbury district, Ontario, contributed about 35.7 per cent of the tonnage, the balance being lead ores and other ores treated in lead furnaces and the silver cobalt ores of Ontario treated in silver smelters. Gold and silver ores treated by cyanide processes are not included in this record.

The quantities of the several classes of ores smelted during the past seven years, have been as follows:—

	Nickel-copper ores.	Silver-Cobalt ores.	Lead ores.	Copper-gold Silver ores.	Totals.
1908	360,180	7,182	53,545	1,797,488	2,218,395
1909	462,336	8,384	54,539	1,850,889	2,376,148
1910	628,947	9,466	57,549	1,987,752	2,683,714
1911	610,834	9,330	55,408	1,517,981	2,193,553
1912	725,065	8,097	59,932	2,212,316	3,005,410
1913	823,403	6,124	88,100	2,119,754	3,037,391
1914	947,053	5,661	71,064	1,612,197	2,649,935

The products obtained in Canada from the treatment of these ores include: pig lead produced at Kingston, Ont., (furnace idle in 1914); refined pig lead and lead pipe produced at Trail, B.C., and fine gold, fine silver copper sulphate and antimony produced from the residues of the Trail lead refinery; silver bullion, white arsenic, nickel oxide and cobalt oxide produced in Ontario from the Cobalt district ores. In addition to these refined products, blister copper, copper matte, nickel-copper matte, cobalt material or mixed nickel and cobalt oxides are produced and exported for refining.

The aggregate results of smelting and refining operations may be summarized as shown in the next table. Unfortunately the figures cannot be taken to represent the total production from smelting ores mined in Canada, since considerable quantities of copper and silver ore are still shipped to other smelters outside of Canada for smelting.

Smelter and Refinery Production in Canada.

Smelter products obtained and exported for refining	1911. Tons	1912. Tons	1913. Tons	1914. Tons
(1) Blister copper	10,710	17,063	15,270	13,238
(2) Copper matte	11,320	6,727	5,159	6,291
(3) Nickel-copper matte	32,607	41,925	47,150	46,396
(4) Cobalt material	630	642	122	101

	Refined products.	Metals contained in matte, blister, and base bullion
Gold, ozs.	11,088	170,818
Silver, ozs.	11,096,861	873,400
Lead, lbs.	36,443,706	....
Copper, lbs.	....	59,237,016
Copper sulphate, lbs.	152,060	....
Nickel, lbs.	....	45,517.937
Cobalt oxide, lbs.	895.789	....
Nickel oxide, lbs.	391,312	....
White arsenic, lbs.	3,474,322	....

(1) Blister copper carrying gold and silver values.
(2) Copper matte carrying gold and silver values.
(3) Bessemer nickel-copper carrying small gold and silver values as well as metals, of the platinum group.
(4) Cobalt material carrying nickel and silver values.

Gold.

The total production of gold, in placer and mill bullion and in smelter products in 1914, is estimated at 770,374 fine ounces valued at $15,925,044 as compared with 802,973 fine ounces valued at $16,598,923 in 1913, showing a decrease of $673,879 or about 4 per cent.

Of the total production in 1914, about $5,695,508 was derived from placer and alluvial mining—$6,050,-690 in bullion from milling ores, and $4,228,846 from matte, blister copper and other smelter products, etc. In 1913, of the total production, about $6,346,072 were derived from alluvial workings; $5,185,544 in bullion from milling ores, and $5,067,307 from smelter products derived from ores, concentrates, etc., smelted.

The production in Nova Scotia and Quebec is small compared with the other provinces but shows an increase of over 25 per cent in 1914.

The Ontario production $5,546,356 shows an increase of over a million dollars due to the extension of milling facilities in the Porcupine field.

No records have been received with respect to gold production in the Beaver Lake district of Saskatchewan or of recoveries from the river bars near Edmonton, Alberta, although activity has been reported in both localities.

The production in British Columbia was $5,177,343, of which $524,000 is credited to placer workings as estimated by the Provincial Mineralogist, and $4,653,-343 to smelter products and bullion from milling ores. The British Columbia production in 1913 was $6,149,-027, being $510,000 from placer workings, and $5,639,-027 from smelter products and mill bullion.

The Yukon production shows a falling off of $721,-384, the total in 1914 being $5,125,396 including a small value in mill bullion, as against $5,846,780 in 1913. The total amount on which royalty was paid during the year 1914, according to the records of the Mining Lands and Yukon Branch, Interior Department, was 309,691.17 oz. as against 352,900.04 ozs. in 1913.

The exports of gold bearing dust, nuggets, gold in ore, etc., in 1914, were valued at $15,242,200.

Silver.

The falling off in price of silver amounting to 4 cents on the average price for the year, the cessation of price quotations and the difficulties of marketing the metal immediately following the declaration of war restricted operations in the Cobalt camp, causing a lower production than might have been expected under normal conditions.

The total Canadian production in 1914 was 27,544,-231 ozs. valued at $15,097,269, as against 31,845,803 ounces valued at $19,040,924 in 1913, a decrease of 4,301,572 ozs. or 13.5 per cent in quantity, and of $3,943,655, or 20.7 per cent in total value.

Of the total production 24,215,926 ozs. or 88 per cent is credited to Ontario. The production from the silver camps is reported as 9,614,069 fine ozs. in bullion shipped, and 14,544,524 ozs. (after deducting 5 per cent for smelter losses) contained in ore and concentrates shipped from Cobalt district. There is also included in the total a small quantity of silver contained in gold bullion shipped.

The Ontario production in 1913 was 28,411,261 ozs. showing a falling off for the province of 4,003,805 ozs. or about 14.1 per cent.

In addition to the bullion shipments from the Cobalt camp, 9,052,993 ozs. were produced in other silver refineries in the province, making a total of 18,667,062 ozs. or 67.7 per cent of the Ontario production recovered within the province in the form of bullion.

The production in British Columbia, representing refined silver and silver contained in smelter products and estimated recoveries from ores exported, was in 1914 about 3,212.111 ozs. as compared with 3,312,343 ozs. in 1913.

In Quebec province there is a small silver content in the pyrites ores shipped, while in the Yukon 67,432 ozs. are estimated as being contained in the placer gold produced and recovered from the copper ores shipped from Whitehorse.

The exports of silver bullion and silver in ore, etc., as reported by the Customs Department, were 28,020,-089 ozs. valued at $15,584,813. There is also an importation recorded of silver in bars, blocks, etc., valued at $629,279.

The price of silver in New York reached a maximum of 59 cents during the first week of May but fell off to 49 cents during the last two months of the year.

Copper.

The copper situation in 1914 was marked by an increased production in Ontario and Quebec as against a falling off in British Columbia and the Yukon, leaving the net result as a very slight decrease.

The copper contained in matte, blister copper, etc., produced in Canadian smelters together with the estimated recoveries or amounts paid for in ores exported amounted in 1914 to 75,738,386 lbs. which, at the average New York value of refined copper, would be worth $10,301,935. Compared with the production in 1913, which was 76,976,925 lbs. valued at $11,753,-606, there was a falling off of only 1,238,539 lbs. or 1.6 per cent, but, owing to the lower price, a much larger percentage decrease in total value.

The production in Quebec from pyrites ores was 4,201,497 lbs. as compared with 3,445,887 lbs in 1913. The actual copper content of the ores shipped was nearly 50 per cent. in excess of these figures, but only about two-thirds of the copper is reported as paid for.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine, although there is a small amount of copper contained in the silver ores shipped from Cobalt, some of which is paid for. There was also a small shipment from the Dane mine on the T. & N. O. railway.

The production in 1914 is reported as 28,948,211 lbs. an increase of 3,062,282 lbs. over the 1913 output which was 25,885,929 lbs. The Mond Nickel Company contributed a much larger percentage of the total production during 1914 than in 1913, and, as this Company's ores are higher in copper than those being worked by the Canadian Copper Company, we have the perhaps somewhat unexpected result of a decrease

in nickel production accompanied by an increase in copper production from these Sudbury district ores.

The British Columbia production was 41,221,628 lbs. as against 45,791,579 lbs. in 1913, a falling off of 4,569,951 lbs. The Greenwood smelter closed down in August and the Grand Forks smelter restricted its operations very severely on the outbreak of war, but started up several furnaces again before the close of the year. The blowing in of the smelter at Anyox, treating the Hidden Creek and other coast ores, and the continuance of large shipments from the Britannia mine made the coast production slightly greater than that of the southern interior smelters and, with an increased production at Trail, almost compensated for the falling off in the Boundary district.

The Pueblo mine was again the principal copper producer in the Yukon with an output only slightly less than that in 1913.

The New York price of electrolytic copper fell off from 14.7 cents in February to 12.7 cents during the last week of July. Quotations ceased on the declaration of war but were resumed in November at a little over 11 cents, increasing to 13.2 cents in December. The average monthly price for the year was 13.602 cents as against 15.269 cents in 1913, and was with the exceptions of 1912 and 1913 the highest average since 1907.

There was a large falling off in the imports of copper of all kinds in 1914. The total imports were valued at $4,256,901 and included crude and manufactured copper, 28,280,812 lbs. valued at $3,983,322, copper sulphate 1,143,039 lbs. valued at $53,802 and other manufactures of copper valued at $219,777. The total imports in 1913 were valued at $7,415,008 and included crude and manufactured copper, 41,011,961 lbs. valued at $6,935,822, copper sulphate 2,037,714 lbs. valued at $107,960 and other manufactures valued at $371,226.

The exports of copper were: copper fine in ore, matte, etc., 68,830,059 lbs. valued at $7,130,778 and copper black or coarse, etc., 6,581,564 lbs. valued at $908,201, a total of 75,411,623 lbs. valued at $8,038,979.

Lead.

The smelter production of lead from Canadian ores in 1914 was 36,337,765 lbs. which valued at 4.479 cents per lb., the average price of pig lead in Montreal for the year, would be worth $1,627,568. The production in 1913 was 37,662,703 lbs. valued at $1,754,705. With the exception of a small tonnage from the Yukon, the 1914 production was entirely from British Columbia ores, and was almost all recovered at the Trail smelter.

The exports of lead in ore, etc., in 1914 are reported as 246,100 lbs. valued at $2,681 and of pig lead 510,573 lbs. valued at $19,507.

The total value of the imports of lead and lead products in 1914 was $1.042,538 and included old scrap and pig lead, 15,444,100 lbs. valued at $590,557, manufactured lead 3,394,930 lbs. valued at $186,165, manufactures n.o.p., $99,285, and litharge and lead pigments $166,531. The imports of litharge and pigment would contain approximately 1,449 tons of metallic lead and the total imports of metallic lead would therefore exceed 10,869 tons.

The average monthly price of lead in Montreal during 1914 was 4.479 cents as against 4.659 cents in 1913. This is the producer's price for lead in car lots as per quotations kindly furnished by Messrs. Thos. Robertson and Co.

The average monthly price of lead in New York was 3.862 cents and in London £19.079 per gross ton, equivalent to 4.146 cents per lb.

Nickel.

The declaration of war resulted in the almost immediate closing down of a considerable portion of the mining and smelting operations of the Canadian Copper Company in the Sudbury district, and although they were partially resumed before the close of the year the Company's output was greatly reduced. The Mond Nickel Company on the other hand, having increased the capacity of its smelter at Coniston, nearly doubled its output. Ores from the Alexo nickel north of Cobalt were also reduced in this smelter. Ten separate properties were worked by these companies.

The nickel-copper ore is reduced in smelters and converters to a Bessemer matte containing from 77 to 82 per cent of the combined metals and shipped in that form to Great Britain and the United States for refining; the product of the Canadian Copper Company going to New Jersey and that of the Mond Nickel Company to Wales. A portion of the matte produced by the Canadian Copper Company is used for the direct production of Monel metal, an alloy of nickel and copper, without the intermediate refining of either metal.

The total production of matte in 1914 was 46,396 tons valued by the producers at the smelters at $7,189,031, and containing 28,895,825 lbs. of copper and 45,517,937 lbs. of nickel. The tonnage of ore smelted (part being previously roasted) was 947,053. The production in 1913 was 47,150 tons of matte, containing 25,875,546 lbs. of copper and 49,676,772 lbs. of nickel, showing an increase in 1914 in copper content and a falling off in nickel.

There is also a small recovery of nickel in the form of nickel oxide from the Cobalt district ores, the production in 1914 being reported as 391,312 lbs. of oxide valued at $26,483.

The aggregate results of the smelting operations on nickel-copper ores during the past five years and the exports of nickel are shown in tabular form while a record taken from the "Foreign Commerce of the United States" has been added showing the imports of nickel into, and exports from that country. The values of the United States exports, which are not quoted in the tables, range from 31 to 39 cents per lb. and averaged about 34 cents in 1914.

It will be noted that a much larger quantity of nickel finds its way to the United Kingdom through United States refineries than is exported directly from Canada.

Exports of nickel from New Caledonia for the first seven months of 1914 are reported as 52,498 metric tons of ore and 2,275 tons matte, of which the total nickel content would probably not exceed 8,000,000 lbs.

The price of refined nickel in New York remained fairly constant throughout the year, quotations published by the Engineering and Mining Journal, 40 to 45 cents per lb. for nickel shot, blocks or plaquettes; electrolytic 5 cents higher per lb.

Production of Nickel in Canada.	1911. Tons of 2,000 lbs.	1912. Tons of 2,000 lbs.	1913. Tons of 2,000 lbs.	1914. Tons of 2,000 lbs.
Ore mined	612,511	737,584	784,697	1,000,364
Ore smelted	610,834	725,065	823,403	947,053
Bessemer matte pro...	32,607	41,925	47,150	46,396
Copper con. of matte..	8,966	11,116	12,938	14,448
Nickel con. of matte..	17,049	22,421	24,838	22,759
Spot value of matte...	$4,945,592	$6,303,102	$7,076,945	$7,189,031

Exports of Nickel Matte from Canada.	Lbs.	Lbs.	Lbs.	Lbs.
Nickel contained in matte, etc.—				
To Great Britain ...	5,023,393	5,072,867	5,164,512	10,291,979
To United States ...	27,596,578	39,148,993	44,224,119	36,015,642
To other countries .	....	....	70,386	220,706
	32,619,971	44,221,860	49,459,017	46,538,327

Imports of Nickel into United States.	1911.	1912.	1913.	1914.
Gross tons of ore and matte, tons	23,993	33,101	37,623	29,564
Nickel contents, lbs....	29,545,967	42,168,769	47,194,101	35,006,700
Exports of nickel from United States—				
To France. lbs.	5,463,358	5,083,947	3,631,858	3,457,157
To Netherlands, lbs.	9,101,150	7,387,447	6,622,811	855,168
To United Kingdom, lbs.	7,196,259	8,191,364	8,221,640	10,836,369
To other countries, lbs.	3,338,819	5,152,258	10,096,779	12,446,458
Total lbs.	25,099,586	25,815,016	29,173,088	27,595,152

Iron Ore.

The iron ore shipments from mines in Canada during 1914 are reported as 244.854 short tons valued at $542.041. These shipments included 199,292 tons of hematite and roasted siderite and 45.562 tons of magnetite and concentrates.

The total shipments of ore in 1913 were 307,634 tons including 92,386 tons of hematite and roasted siderite, 209.886 tons of magnetite and concentrates and 5.362 tons of titaniferous ore.

Exports of iron from Canada during 1914 were recorded by the Customs Department as 135,451 tons valued at $360,974.

According to mine operators' reports however 184,444 tons were shipped to Canadian smelters, and 60,410 tons were exported to the United States. The imports into the United States from Canada are also reported by the Washington Trade Statistics as 58,816 tons, valued at $153,415.

Imports of iron ore in 1914 were, according to Customs records, 1.147,108 tons, valued at $2,387,358.

Shipments of iron ore from the Wabana mines, Newfoundland, in 1914, by the two Canadian companies operating there were 639,430 short tons, of which 422,920 tons were shipped to Sydney, Cape Breton, and 216,510 tons to the United States and Europe. In 1913 the shipments were 1,605,920 short tons, of which 1,048,432 tons were shipped to Sydney, and 557.488 tons to the United States and Europe.

Pig Iron.

The total production of pig iron in Canadian blast furnaces in 1914 was 783.164 tons of 2.000 lbs., valued at approximately $10,002,856, as compared with 1,128.967 tons, valued at $16.540.012 in 1913. A large portion of this production is used directly in the manufacture of steel and the values are in part estimated. The output shows a falling off of 345.803 tons or 30.6 per cent. and is the smallest since 1909.

Of the total production in 1914, 9,380 tons were made with charcoal and 773.784 tons with coke. The classification of the production, according to the purpose for which it was intended, was as follows: Bessemer 230.817, basic 346.553, foundry and malleable 205.794.

The ore charged to blast furnaces included 182,964 tons of Canadian ore and 1,324,326 tons of imported ore, and 33.583 tons of mill cinder, etc. The amount of coke used during the year was 921,171 tons, comprising 330.269 tons from Canadian coal, and 590,902 tons of imported coke or coke made from imported coal. The quantity of charcoal fuel used was 920.045 bushels and of limestone flux 447.636 tons.

The number of men employed at blast furnaces was 1,018 and total wages paid $693.632.

The furnace plants operated for varying periods of time included those of the Dominion Iron & Steel Co., and the Nova Scotia Steel & Coal Co., at Sydney, and North Sydney; the Algoma Steel Co., at Sault St. Marie; the Steel Co. of Canada at Hamilton, the Standard Iron Co. at Deseronto, and the Canadian Iron Furnace Co. at Port Colborne. All other furnaces were idle throughout the year.

The production of pig iron by provinces in 1914 was as follows:

1914.	Tons.	Value.	Value per ton
Nova Scotia	227,052	2,951,676	$13.00
Ontario.	556,112	7,051,180	12.68
	783,164	10,002,856	12.77

There was also a production during 1914 in electric furnaces of 7,524 tons of ferro alloys (ferro-silicon and ferro-phosphorus) valued at $478.354, compared with 8.075 tons valued at $493,018 in 1913. This production is chiefly 50 per cent ferro-silicon.

The exports of pig iron and ferro-silicon etc., during the year are reported as 19.063 tons, valued at $486.366. The imports were: pig iron 78,594 tons valued at $981,107; charcoal pig 86 tons, valued at $1.082; ferro-manganese and ferro-silicon 22,147 tons, valued at $549,485; or a total of 100,827 tons, valued at $1.531,674.

Coal and Coke.

The total production of marketable coal for the year 1914 comprising sales and shipments, colliery consumption and coal used in making coke or otherwise used by the colliery operators, was 13,594,984 short tons, valued at $33,433,108, as against 15,012,178 tons, valued at $37,334.940 in 1913, showing a decrease of 1.417.194 tons, or 9.4 per cent in quantity and of $3.901,832, or 10.4 per cent in total value.

In estimating the values of the coals, arbitrary values are assumed for Nova Scotia and for British Columbia, viz: $2.50 per long ton for the former and $3.50 per long ton for the latter. The value of the coal production in the other provinces is that returned by the operators. The production in Nova Scotia was 7,338,790 tons, a falling off of 641.283 tons, or 8.0 per cent. The Alberta production as kindly furnished by Mr. John Stirling, Inspector of Mines, Alberta, was 3,667,816 tons, a decrease of 346,939 tons or 8.6 per cent, while the British Columbia production was 2,238,339 tons a decrease of 476,081 tons or 21.2 per cent. Sasketchewan with a production of 232,541 tons shows in increase of 19.644 tons or 9.2 per cent, while New Brunswick reports a production of 104,055 tons, an increase of 33,744 tons or 48 per cent. The production of the Yukon is reported as 13,443 tons, a decrease of 6,279 tons or 32 per cent from 1913.

Production of Coal by Provinces 1914.

	Tons.	Value.
Nova Scotia	7,338,790	$16,381,228
British Columbia	2,238,339	6,994,810
Alberta.	3,667,816	9,367,602
Saskatchewan.	232,541	375,438
New Brunswick	104,055	260,270
Yukon.	13,443	53,760
Total.	13,594,984	$33,433,108

The exports of coal in 1914 were 1,423,126 tons, valued at $3,880,175 as compared with exports of 1.562.020 tons valued at $3,961,351 in 1913, a falling off of 138.894 tons or 8.89 per cent.

Imports of coal during the year included bituminous, round and run of mine 7,776,415 tons, valued at $14,954,321, or an average of $1.92 per ton; bitumin-

ous slack 2,509,632 tons valued at $3,605,253 or an average of $1.43 per ton; and anthracite 4,435,010 tons valued at $21,241,924 or an average of $4.79 per ton or a total of 14,721,057 tons, valued at $39,801,498. The imports in 1913 were bituminous, round and run of mine 10,743,473 tons valued at $21,756,658; bituminous slack 2,816,423 tons, valued at $4,157,622; and anthracite 4,642.057 tons valued at $22,034,839; or a total of 18,201,953 tons valued at $47,949,119.

There was therefore a decrease in imports of bituminous run of mine of 2,967,058 tons or 27.6 per cent, a decrease in the imports of bituminous slack of 306,791 tons or 10.9 per cent and a decrease in the imports of anthracite of 207,047 tons or 4.5 per cent or a total decrease in coal imports of 3,480,896 tons or 19.1 per cent.

The apparent consumption of coal during the year was 26,809,778 tons as against a consumption of 31,582,545 tons in 1913. Of the consumption in 1914 about 45.4 per cent was from Canadian mines and 54.6 per cent imported.

Coke.—The total output of oven coke during 1914 was 1,015,253 tons of 2,000 lbs. made from 1,533,365 tons of coal, of which 1,030,053 tons were mined in Canada, and 503,312 tons were imported. The total quantity of coke sold, or used by the producers during the year was 1,019,082 tons valued at $3,634,511.

In 1913 the total output was 1,517,133 tons and the quantity sold or used by the producers 1,530,499 tons valued at $5,919,596.

The output by provinces in 1914 was; Nova Scotia 345,880 tons; Ontario 377,514 tons; Alberta 28,541 tons, and British Columbia 263,318 tons. The production from Ontario was entirely from imported coal.

By-products from coke ovens during the year included 8,572 tons of ammonia sulphate; 5,714,172 gallons of tar and 3,201,097 thousand ft. of gas.

The only coke ovens operated during the year were those at Sydney, Sydney Mines and Westville, Nova Scotia; Sault St. Marie, Ontario; Coleman, Alberta; and Fernie, Michel and Hosmer, British Columbia. At the end of the year there were 797 ovens in operation and 2,297 idle.

Asbestos.

The asbestos production in 1914 was obtained from the districts of Black Lake, Thetford, Robertsonville, and Danville in the province of Quebec. Both output and sales show a considerable falling off while there is an increase in the stocks on hand at the close of the year, a result which is no doubt due largely, if not entirely, to the war.

The total output in 1914 was 107,668 tons, as against 132,564 tons in 1913, a falling off of 24,896 tons, or 18.7 per cent. Notwithstanding this decrease the output was greater than that of any other preceding year. The sales and shipments of asbestos during 1914 were 96.542 tons, valued at $2,892,266 or an average of $29.96 per ton, as against sales in 1913 of 136,951 tons valued at 3,830,909, or an average of $27.97 per ton. The 1914 sales were exceeded during each of the previous three years. Stocks on hand at December 31, 1914, were 31,171 tons, as compared with stocks of 20,787 tons at the end of the previous year.

The number of men employed in mines or quarries and mills, was 2,992 and amount paid in wages $1,283,977, as against 2,951 men employed, and $1,687,957 paid in wages in 1913.

The total quantity of asbestos rock milled during the year is reported as 1,717,629 tons which, with a mill production of 103,607 tons, shows an average estimated content of about 6.03 per cent of fibre in the rock.

The output and sales of crude and mill stock separately is shown for 1913 and 1914, in the following tables. The classification is based on valuation: Crude No. 1, comprising material valued at $200 per ton and upwards, and Crude No. 2, under $200; mill stock No. 1, includes mill fibre valued at from $30 upwards, No. 2 from $15 to $30, and No. 3 under $15.

The total sales of crude asbestos in 1914 were 4,147.5 tons valued at $773,193 or an average of $186.42 as against sales in 1913 of 5,660.3 tons, valued at $989,162, or an average of $174.45 per ton, showing a lower tonnage but a higher average value in 1914.

The total sales of mill stock in 1914 were 92,394 tons, valued at $2,119,073, or an average of $22.94 per ton, as against 131,291 tons in 1913, valued at $2,841,747, or an average of $21.64 per ton, again a smaller tonnage but a higher average price than in the previous year.

Exports of asbestos during the twelve months ending December 31, 1914, were 81,081 tons, valued at $2,298,646 as against 103,812 tons, valued at $2,848,047 exported in 1913. There was also an export classed as asbestos sand in 1914, amounting to 18,991 tons, valued at $108,548, or an average value per ton of $5.71.

Output Sales and Stocks of Asbestos in 1914.

	Output. Tons.	Tons.	Value	Per ton.	Stock on hand Dec. 31 Tons.	Value.	Per ton.
Crude No. 1.	1,450.55	1,335.9	402,417	$301.23	984.3	$301,237	$306.04
Crude No. 2.	2,610.4	2,811.65	370,776	131.87	1,410.9	187,338	132.78
Mill stock No. 1	16,144	19,388	932,893	48.12	4,616	229,361	49.69
Mill stock No. 2	58,362	47,851	963,973	20.15	15,114	305,809	20.23
Mill stock No. 3	29,101	25,155	222,207	8.83	9,046	76,522	8.46
Asbestos.	107,667.95	96,541.55	2,892,266	29.96	31,171.2	1,100,267	35.30
Asbestic.	....	21,031	17,540	0.83	....	....	......

Petroleum and Natural Gas.

Although crude oil has been struck in several of the prospect wells being sunk in Alberta and a few thousand gallons obtained from the Dingman Well, No. 1, of the Calgary Petroleum Products, Ltd., were sold, the western fields have not, as yet, reached the stage of commercial production and the Canadian output is still practically confined to the old established fields in Ontario supplemented by a few barrels pumped from gas wells in New Brunswick.

The annual output, which has been steadily declining during the past seven years, shows a further falling off in 1914. The average price received for crude oil was also lower than in the previous year.

A bounty of one and a half cents per imperial gallon is paid upon the production of crude petroleum, the Petroleum Bounty Act being administered and payments made by the Department of Trade and Commerce.

According to the records of this department, the total output of petroleum in Ontario and New Brunswick during 1914 was 214,418 barrels, or 7,504,619 gallons on which a bounty of $340,924 was paid. The

average monthly price per barrel at Petrolia was $1.59 as compared with $1.782 in 1913. During the first three months of 1914, $1.89 per barrel was quoted, but the price decreased to a minimum of $1.33 during the past three months of the year.

In addition to the above 13,549 gallons, or 387 barrels, valued at $2,200, were reported as having been sold from the Dingman Well in Alberta upon which no bounty was claimed. The total Canadian production is therefore stated as 7,518.168 gallons or 214,805 barrels valued at $343,124.

The production in 1913 was 7.982.798 gallons, or 228.080 barrels, valued at $406.439. The production in Ontario during 1914 included in the above total was 212.693 barrels. The production by districts in this province, as furnished by the Supervisor of Petroleum Bounties, at Petrolia, was as follows, in barrels: Lambton, 154.186; Tilbury, 18.530 Bothwell, 33,961; Dutton, 2 190; Onondaga, 2.437, and Belle River, 1,191, or a total of 212.495 barrels. In 1913 the production by districts was; Lambton, 155.747; Tilbury, 26,824; Bothwell, 34.349; Dutton, 4.610; Onondaga, 4,172, and Belle River, 464, or a total of 226.166 barrels.

The production in New Brunswick in 1914 was 1,725 barrels, as against 2,111 barrels in 1913, and 2,679 barrels in 1912.

Exports of petroleum entered as crude mineral oil in 1914 were 3,996 gallons valued at $362, and of refined oil 3.922 gallons valued at $826. There was also an export of naptha and gasoline of 43.023 gallons valued at $11.607.

The total value of the imports of petroleum and Petroleum products in 1914 was $11.174.763, as against a value of $13.348.326 in 1913.

The total imports of petroleum oils, crude and refined in 1914 were 244 487.973 gallons valued at $11.-072.362 in addition to 1 594.236 lbs. of wax and candles valued at $102.401. The oil imports included: crude oil. 195.207.210 gallons valued at $5.750.971; refined and illuminating oils, 12 833.065 gallons valued at $970 481; gasoline, 24 396.401 gallons valued at $2,-747.360; lubricating oils, 5.767.676 gallons valued at $940.143, and other petroleum products, 6.282,621 gallons valued at $663.407.

The total imports in 1913 were 222.779.028 gallons of petroleum oils crude and refined valued at $13,238.-429, in addition to 1.628 837 lbs. of paraffin wax and candles valued at $109.897. The oil imports included: crude oil, 162.061.926 gallons, valued at $5.250.835; refined and illuminating oils 19.393.627 gallons, valued at $1.394 440; gasoline, 29.525.180 gallons, valued at $4.822.941; lubricating oils, 6,789,451 gallons, valued at $1.172.986, and other petroleum products, 5,008,844 gallons, valued at $597.227.

There was thus in 1914 an increased importation of crude oils and a decrease in imports of refined illuminating oils, lubricating oils and gasoline.

Natural Gas.

The total production in 1914 was approximately 21,-047 million ft., valued at $3,511,302, of which 426 million ft., valued at $54,249 was produced in New Brunswick; 13,675 million ft., valued at $2,206,733, in Ontario; and 6,946 million ft. valued at $1,250,320 in Alberta.

The production in 1913 was 20.478 million cu. ft., valued at $3,307,381 of which 829 million ft. valued at $174.147 was produced in New Brunswick; 12,475 million ft. valued at $2,055,768, in Ontario; and 7,174 million ft., valued at $1,079,466, in Alberta.

These values represent as closely as can be ascertained the value received by the owners or operators of the wells for gas produced and sold or used. The values do not represent what consumers have to pay, since, in cases where transmission is by separately operated pipe line companies, such cost is not included.

Cement.

The year 1914 has witnessed a very large falling off in the production of nearly all materials of construction. This situation while possibly aggravated by the war was due primarily to conditions which had already begun to show their effects during the latter part of 1913.

The total quantity of Portland cement, including slag cement and natural Portland, made in 1914 was 8.727.269 barrels of 350 net lbs. each as compared with 8.886.333 barrels made in 1913, a decrease of 159.064 barrels, or about 2 per cent.

The total quantity of Canadian Portland cement sold or used during 1914 was 7.172.480 barrels valued at $9.187.924 or an average of $1.28 per barrel, as compared with 8.658.805 barrels valued at $11.019.418 or an average of $1.27 per barrel in 1913, showing a decrease of 1.486.325 barrels, or 17 per cent.

The total imports of cement in 1914 were 343.076 cwt. equivalent to 98.022 barrels of 350 lbs. valued at $147.158, or an average of $1.50 per barrel, as compared with imports of 254,093 barrels valued at $409,-303, or an average of $1.61 in 1913.

The total consumption of cement therefore, neglecting a small export, was 7,270.502 barrels, as compared with a consumption of 8,912.898 barrels in 1913; a decrease of 1,642.396 barrels, or 18.4 per cent.

Production of Cement 1913 and 1914.

	1913. Bbls.	1914. Bbls.
Portland cement sold	8,658,805	7,172,480
Portland cement manufactured	8,886,333	*8,727,269
Stock on hand Jan. 1st	862,067	*1,074,610
Stock on hand Dec. 31st	1,089,595	*2,629,399
Value of cement sold	$11,019,418	$9,187,924
Wages paid	3,466,451	....
Men employed	4,276	....

*Partly estimated.

The average price per barrel at the works in 1914 was $1.28 as compared with $1.27 in 1913, 01.28 in 1912, and $1.34 during 1911 and 1910.

The imports of cement in 1914 included 26,774 barrels valued at $35,517 from Great Britain; 69,117 barrels valued at $108,487 from the United States, and 2,131 barrels valued at $3,154 from other countries.

Exports of Products of the Mine and Manufactures of Mine Products, Calendar Year, 1914.

(Compiled from Trade and Navigation Monthly Statements.)

Products.	Quantity.	Value.
Arsenic, cwt.	37,519	$132,567
Asbestos, tons	81,081	2,298,643
Asbestos sand, tons	18,991	108,548
Coal, tons	1,423,126	3,880,175
Feldspar, tons	18,072	74,100
Gold	....	15,242,200
Gypsum, tons	345,830	404,234
Copper, fine, in ore, etc., lbs.	68,830,059	7,130,778
Copper, black or coarse in pigs, lbs.	6,581,564	908,201
Lead, in ore, etc., lbs.	246,100	2,681
Lead, pig, etc., lbs.	510,573	19,507
Nickel, in ore, etc., lbs.	46,528,327	5,149,427
Platinum, ozs.	43	2,161
Silver, ozs.	28,020,089	15,584,813
Mica, lbs.	669,163	178,940
Mineral pigments, cwt.	35,549	22,311
Mineral water, gals.	2,287	599
Oil, mineral, crude, etc., gals.	3,996	362
Oil, refined, gals.	3,922	826
Ores—		
Antimony, tons	....	....
Corundum, tons	947	87,740
Iron, tons	135,451	360,974
Manganese, tons	30	750
Other ores, tons	12,770	782,437

Phosphate, tons	247	677
Plumbago, cwt.	18,375	50,528
Pyrites, tons	89,999	377,985
Salt, cwt.	9,527	5,229
Sand and gravel, tons	952,370	802,358
Stone, ornamental, tons	231	5,607
Stone, building, tons	63,009	46,198
Stone, crushed, tons	25,130	18,153
Stone, for man. of grindstones, tons	54	294
Other products of the mine	....	101,096
Total mine products	....	53,781,102
Manufactures.		
Agricultural Implements—		
Mowing machines	21,457	725,831
Cultivators	6,030	146,668
Reapers	3,919	223,228
Drills	3,961	259,701
Harvesters and binders	19,474	2,019,996
Ploughs	12,896	324,349
Harrows	6,252	92,556
Hay rakes	6,524	196,519
Seeders	32	1,810
Threshing machines	1,965	799,307
All other	....	290,520
Parts of	....	712,414
Asbestos, manufactures of	....	94,538
Bricks, M.	1,486	11,871
Cement	....	2,223
Clay, manufactures of	....	26,866
Coke, tons	67,838	306,117
Drugs—		
Acetate of lime, lbs.	16,052,255	282,146
Acid sulphuric, lbs.	7,485,509	45,612
Calcium carbide, lbs.	15,447,014	470,387
Phosphorus, lbs.	610,350	92,303
Earthenware and manufactures of	....	9,336
Fertilizers	....	2,390,494
Grindstones, manufactured	....	24,113
Gypsum and plaster ground	....	35,490
Iron and steel and manufactures of—		
Stoves	4,198	25,149
Gas buoys and parts of	....	21,009
Castings, N.O.P.	....	24,218
Pig iron, tons	14,198	201,145
Ferro-Silicon, Ferro-Com., tons	4,865	285,221
Wire and wire nails, cwt.	193,255	355,781
Linotype machines and parts of	....	5,562
Machinery, N.O.P.	....	344,689
Sewing machines	2,109	31,392
Washing machines	....	33,986
Typewriters	3,055	200,441
Scrap iron and steel, cwt.	708,107	446,337
Hardware, viz. tools, etc.	....	95,497
Hardware, N.O.P.	....	190,763
All other, N.O.P.	....	2,931,908
Lime	....	16,927
Metals—		
Aluminum, in bars, etc., cwt.	145,108	2,364,907
Aluminum, manufactures of	....	5,571
Brass, old and scrap, cwt.	21,209	196,710
Copper, old and scrap, cwt.	19,871	231,710
Metallic shingles, etc.	....	105,663
Metals, N.O.P.	....	393,829
Mineral and aerated water in bottles	....	1,768
Oil, gasoline and naptha, gals.	43,023	11,607
Oil, N.O.P., gals.	455,867	104,179
Plumbago, manufactures of	....	72,718
Stone, ornamental	....	1,752
Stone, building	....	370
Tar	....	36,719
Tin, manufactures of	....	24,531
Vehicles—		
Automobiles	5,621	3,011,327
Automobile parts	....	384,428
Bicycles	111	10,021
Bicycle parts	....	3,973
Total manufactures	....	21,752,203
Grand total	....	75,533,305

MINERAL PRODUCTION OF ONTARIO, 1914

By Thos. W. Gibson, Deputy Minister of Mines.

The growth which marked the output of the mining industry of Ontario during the previous decade underwent a decided check in 1914, the value of the production being $46,632,105, as compared with $53,232,311 in 1913—a decrease of $6,600,206, or 12.3 per cent. It fell below the level of 1912 by $1,641,406, but considerably exceeded that of any preceding year. The decrease was somewhat greater in amount in the metallic than in the non-metallic products, being $3,638,438, as compared with $2,961,768. Since the value of the metallic output was much greater than of the non-metallic—being $33,869,497, as compared with $12,762,608—the decrease in the metals was much less in proportion, being only 10.8 as against 23 in the non-metals.

The causes of the diminution are not far to seek. Early in 1914 it became evident that a business depression had set in which in any event would have the effect of curtailing the output of many mineral products, notably pig iron and materials of construction. But the outbreak of war in the beginning of August frightened capital, shut off demand, lowered prices and consequently diminished production in nearly every branch of the industry, gold mining being almost the only exception. For a time it seemed as if a number of the Cobalt silver mines would have to shut down altogether from inability to market their product, and the Canadian Copper Company, the leading producer of nickel, reduced the number of its furnaces in blast from six to two. Fortunately, this condition was of short duration; the silver mines resumed operations, and ere the close of the year the Copper Company had four furnaces in operation and was preparing for resumption of a normal output. The low price of silver and the diminished production of several of the mines aided in reducing the yield from Cobalt, and it is a testimony to the productivity of that remarkable field that the decrease in fine ounces of silver as compared with 1913 was considerably less than four million.

Mineral Products of Ontario, 1914.

Metallic—			
Gold, oz.	268,942	$5,529,767	$4,558,518
Silver, oz.	25,999,374	13,209,726	16,579,094
Copper, tons	14,453	2,081,332	1,840,492
Nickel, tons	22,760	5,109,088	5,237,477
Iron ore, tons	240,059	531,379	424,072
Pig iron, tons	556,112	7,041,079	8,719,892
Cobalt ore, tons	97	27,743	....
Cobalt oxide, lbs.	640,653	516,542	
Nickel oxide, lbs.	303,752	27,716	433,712
Cobalt and nickel oxides, unseparated, lbs.	113,843	45,189	
		34,231,449	37,793,257
Less Ontario iron ore smelted into pig iron (163,779 tons)	....	361,952	285,322
Net value metallic production	....	33,869,497	37,507,935
Non-Metallic—			
Arsenic, refined, lbs.	4,059,868	116,624	64,146
Brick, common	294,400,000	2,336,207	3,452,352
Tile, drain	14,710,000	277,530	292,767
Brick, paving, etc.	11,455,000	128,800	243,119
Brick, pressed	60,620,000	646,604	919,741
Stone, building, etc.	....	1,088,862	1,137,153
Calcium carbide, tons	2,381	142,883	123,100
Cement, Portland, bbls.	2,609,750	2,852,930	4,105,455
Corundum, tons	548	65,730	137,036
Feldspar, tons	18,062	55,686	67,142
Graphite, refined, tons	1,363	87,167	93,054
Gypsum, tons	106,643	229,269	92,627
Iron pyrites, tons	107,258	264,722	171,687
Lime, bush.	2,075,228	333,363	390,600
Mica, tons	349	40,402	55,264
Natural gas, M. cu. ft.	13,223	2,347,737	2,362,021
Peat, tons	600	2,100	1,750
Petroleum, Imp. gals	7,437,356	337,867	398,051
Phosphate of lime, tons	450	3,150	....
Pottery	....	25,720	52,875
Quartz, tons	52,947	82,544	130,860
Salt, tons	104,774	498,383	474,372
Sand and gravel, cu. yds.	359,100	151,909	233,567
Sewer pipe	....	571,756	600,297
Talc, tons	10,435	74,583	125,340
Non-metallic production	....	12,762,608	15,724,376
Add metallic production	....	33,869,497	37,507,935
Total	....	46,632,105	53,232,311

Ontario Gold Production, 1914.

The number of ounces of gold produced last year was 268,942, having a value of $5,529,767 as compared with 220,837 ounces worth $4,558,518 in 1913—an increase of over 21 per cent. The producing mines were 12 in number, eight being in Porcupine and four in other parts of the Province.

About half the total production came from the Hollinger, where 208,936 tons of ore were treated for a yield of 129,364 ounces, or an average of $12.79 per ton. Additions to the milling capacity of this mine were under construction during the year, which, when completed, will increase the ore handled from 500 to 1,600 tons per day. Underground development in-

creased the estimated value of ore reserves from $11,-604,800 at the beginning of 1914 to $13,358,420 at the beginning of 1915. At the Dome mine 51,026 ozs. were obtained from 221,390 tons of ore, an average of $4.76 per ton. Porcupine Crown milled 40,857 tons and recovered 33,020 ozs., the average being $16.70 per ton. At McIntyre Porcupine 62,284 tons of ore were treated and 26,398 ozs. of gold won, an average return of $8.75 per ton. The other producers in the Porcupine camp were the Acme, Mines Leasing (Rea), Porcupine Pet and Porcupine Vipond.

At Long lake, the Canadian Exploration Company, having enlarged its plant, nearly doubled its 1913 output. Tough-Oakes, at Kirkland lake, was busy installing a new mill which is expected to go into operation this month; meantime the yield from 3,734 tons of ore amounted to 5,524 ozs. of gold. La Mine D'or Huronia, in Gauthier township, and Cordova, in Belmont township, Peterboro county, made small contributions to the total. Nothing is reported from northwestern Ontario.

For the whole Province, 608,200 tons of ore were crushed, the yield being 268,942 ozs. of gold and 55.153 ozs. of silver, of a total value of $5,559,520, or an average of $9.14 per ton.

The aggregate value of the gold produced in Ontario to 31st December, 1914, was $14,822,995.

Silver.

The output of silver in Ontario in 1914 was 25,999,374 fine ozs., being a decrease, as compared with 1913, of 3,725,557 ozs., or 12.5 per cent., or as compared with 1911, when the Cobalt mines were at their maximum and produced 31,507,791 ozs., or 17.4 per cent.

The return to the mining companies was $13,209,726, an average of 50.807 cents per oz. The average price of fine silver in New York for the twelve months was 54.811 cents per oz., but while at the opening of the year the price was 57.572 cents, rose to 58.519 cents in April, and to 58.175 cents in May, it fell in July to 54.678 cents. In August the price declined to 54.344 cents, and receded month by month until in December it reached 49.375 cents. Since the beginning of 1915 it has continued to fall; the average for January was 48.855 cents, low point, 48 cents, being touched February 3rd.

It may be pointed out that after the outbreak of the war New York prices were largely nominal, and represented little or no actual business. Sales were for a time impossible, and continued to be attended with difficulties, owing to the rise in freights and insurance against war risks, which at one time amounted to 6¼ cents per oz. over and above the usual charges.

The Ontario silver production by camps was as follows:

	Ounces.	Value.
Cobalt proper	24,940,613	$12,678,184
Casey township	499,643	236,298
South Lorrain	104,665	54,310
Gowganda	399,300	211,181
	25,944,221	$13,179,973
Silver recovered from auriferous ores	55,153	29,753
Total	25,999,374	$13,209,726

With regard to the form in which the silver was shipped out from the camp, the figures show a nearly even division among ore, concentrates, and bullion, as follows:

	Tons.	Ounces.	Value.
Ore	4,655	8,447,338	$4,275,519
Concentrates	12,152	8,915,958	4,390,021
Bullion	......	8,580,925	4,514,433
Total	......	25,944,221	$13,179,973

Cobalt silver output—Since the opening of the mines at Cobalt the production of silver has amounted to over 211 million ozs., having a value of more than 111 million dollars, the output by years being as follows:

	Ounces.	Value.
1904	206,875	$111,887
1905	2,451,356	1,360,503
1906	5,401,766	3,667,551
1907	10,023,311	6,155,391
1908	19,437,875	9,133,378
1909	25,897,825	12,461,576
1910	30,645,181	15,478,047
1911	31,507,791	15,953,847
1912	30,243,859	17,408,935
1913	29,681,975	16,553,981
1914	25,944,221	13,179,973
Total	211,442,035	$111,465,069

The average price received for silver during the eleven years was 52.716 cents per fine oz. The total production of silver from all sources up to the end of 1914 had a value of $126,965,109.

It is natural to ask how much longer the mines at Cobalt will last. To this question no definite answer can of course be given. There is little doubt that the decline in output which began in 1912 will continue, probably at an accelerating rate. The typical Cobalt silver mine is essentially high grade, and the economy of nature is seen in the fact that very rich deposits are apt to be small, while low grade bodies tend to be large. Some properties in Cobalt which formerly produced freely are now closed down or have greatly reduced their output. The yield from others, while still considerable, is below its former level. It is not to be concluded, however, that all of the latter class are approaching exhaustion. By the discovery of new veins on the surface or below ground, some have in a measure renewed their youth, and in a number there are reserves of low grade ore which will yield much silver and keep their concentrating plants busy for a considerable time to come. New veins containing high grade ore were discovered in the Beaver and Temiskaming mines. Hope is entertained in this part of the field that if the diabase sill were bottomed productive veins might be found at or near the contact.

Ten Cobalt silver mines produced more than a million ozs. in 1914. Following is the list; the production for 1913 is given for purposes of comparison:

	Oz. 1914.	Oz. 1913.
Nipissing	4,704,499	4,844,169
Mining Corporation of Canada. (Townsite and City of Cobalt)	3,079,275	2,414,760
Coniagas	2,459,007	3,252,566
Kerr Lake	1,817,087	2,072,407
Crown Reserve	1,425,320	1,776,678
Seneca-Superior	1,409,766	1,124,577
La Rose	1,398,404	2,592,775
McKinley-Darragh-Savage	1,260,355	2,228,497
Mining Corporation of Canada. (Cobalt Lake)	1,247,677	980,858
O'Brien	1,231,834	1,240,931

Large acreage, many openings and productive veins early placed Nipissing at the head of the list, where it still remains. Cobalt Townsite and City of Cobalt, united under the management of Mining Corporation of Canada, now take second place, Coniagas being third, instead of second as in 1913. There are other changes in position as compared with the list given in last year's bulletin, but the only new name is Mining Corporation of Canada (Cobalt Lake), which displaces Buffalo.

The silver refineries operating in 1914 were the Coniagas Reduction Company at Thorold, and the Deloro Mining and Reduction Company at Deloro. The Canada Smelting and Refining Works rebuilt their plant at Orillia, destroyed by fire in January, 1913, and resumed work towards the close of 1914. Adding the bullion produced by these works—9,273,247 ounces—to that from the refining plants at Cobalt gives a total of

bullion refined in Ontario of 17,754,172 ozs.—about 68 per cent. of the entire silver production for the year.

At the refineries, too, were produced and shipped 640,653 lbs. of cobalt oxide and 303,752 lbs. of nickel oxide, as well as 113,843 lbs. of these oxides mixed; also 4,059,868 lbs. of white arsenic. One inevitable consequence of the war was the closing of the markets for cobalt and nickel oxide on the continent of Europe. Canadian makers of cobalt oxide now control the trade. Under the provisions of the Metal Refining Bounty Act bounties amounting to $26,038.02 were paid to the refineries on cobalt oxide and $8,978.70 on nickel oxide. The bounty is at the rate of six cents per pound on the metallic contents of the oxides. The Act expires in April, 1917.

Nickel and Copper.

The production of nickel was active during the first six months of 1914 and it looked as if the year's output would surpass the record. The declaration of war at once checked this activity, and the Canadian Copper Company which exports its matte to the United States for refining, cut down its output at once, though increasing it later in the year. The Mond Nickel Company, whose refinery is in Wales, kept its new works at Coniston in full blast, and the year's total of matte was but little less than in 1913, being 46,396 tons as against 47,150. The nickel contents are estimated as 22,760 tons, and the copper contents as 14,453 tons, valued at $5,109,088 and $2,081,332 respectively, including small quantities of both from the Cobalt mines. The copper product exceeded that of 1913 by 1,512 tons in weight and $240,840 in value, the explanation being found in the increased production by the Mond Nickel Company, whose ores contain rather more copper and less nickel than those of the Canadian Copper Company. As regards the figures of value, these are supplied by the companies themselves, the computation being based on the metals as contained in the matte at the point of shipment. They are equivalent to 11.2 cents per lb. for nickel and 7.2 cents for copper.

The quantity of nickel-copper ore raised was 1,072,207 tons, and the quantity smelted 947,053 tons. Some 79,825 tons of this came from the Alexo mine in Dundonald township, and was treated by the Mond Company in their works at Coniston. This company raised 348,074 tons of ore, more than half of which was from the Garson mine, the remainder being from seven other openings, including the Worthington and the new property at Levack. The Canadian Copper Company extracted 618,781 tons, the bulk of it being from the Creighton mine, which is again the chief source of this company's supply. Crean Hill yielded 58,689 tons, No. 2, 42,114 tons, and No. 3 or Frood 87,688. The large scale operations projected at the Frood mine will not for the present be proceeded with.

Iron Ore and Pig Iron.

There was shipped to blast furnaces in Ontario and the United States 115,910 tons of ore from the Helen and Moose Mountain mines, and from the concentrating plants at Trenton, Moose Mountain and Magpie 124,149 tons of concentrates or briquettes, the whole having a value at the mines or works of $531,379. The ore at the Magpie is siderite, and is roasted to eliminate the sulphur and carbonic acid. The analysis of the roasted product is; iron 50 per cent., phosphorus .012, silica 7.24, manganese 2.85, alumina .60, lime 8.34, magnesia 8.05, sulphur .20. The material is reported as being entirely satisfactory from a blast furnace point of view. Moose Mountain briquettes show the following analysis: iron 63.12, phosphorus .036, silica 6.52, manganese .05, alumina 1.00, lime 1.5, magnesia 1.53, sulphur .012. These briquettes have also been very favorably received.

The four blast furnace plants in operation at Sault Ste. Marie, Hamilton, Port Colborne and Deseronto respectively produced 556,112 tons of pig iron, valued at $7,041,079. This is a decrease as compared with 1913 of 14.3 per cent. in quantity and 19.2 per cent. in value. The demand for pig iron began to fall off some time before the declaration of war, and conditions in the business were far from satisfactory at the close of the year.

The quantity of Ontario ore used in making the pig iron was 163,779 tons, and of imported ore 752,560 tons.

Non-Metallic Materials.

Of the 25 substances in the list of non-metallic products, seven only show an increase in value as compared with 1913, these being arsenic, calcium carbide, gypsum, iron pyrites, peat, phosphate of lime and salt. These increases amounted to $330,574, while the decreases on the remaining eighteen products totalled $3,291,217, leaving a net diminution of $2,961,768.

All materials of construction fell off to a considerable degree, the building trade feeling acutely the sudden stoppage of money on the outbreak of war, amounting in many cases to an impossibility of procuring funds to finish houses already begun. Common brick fell off in number by 114,408 thousand and in value by $1,116,145; they were also lower in price per thousand from $8.44 to $7.99. Pressed brick dropped in number by 20,618 thousand, in value by $273,137, and in price from $11.32 to $10.66. The falling off in stone was smaller in proportion, the decrease in value being $48,291. Lime was less by $57,237, and Portland cement by no less than $1,252,525; the price per barrel at the works however remained undiminished, and even rose by two cents. The production of corundum—the demand for which varies with the state of iron and steel manufacturing—was cut in two, the drop being from $137,036 to $65,730. Natural gas remained at practically the same figure so far as value is concerned, but the output was greater, rising from 12,516 million cu. ft. in 1913 to 13,223 million cu. ft. in 1914. Petroleum again showed a decline, the output being 478,405 Imperial gals. less and the value $60,184 less than in 1913. Quartz fell $48,316, mica $14,862, sand and gravel $81,658, and talc $50,757.

The advances in gypsum and iron pyrites were notable. The former gained 66,062 tons in quantity and $136,642 in value; the latter 35,638 tons in quantity and $93,035 in value. There was also a decided gain in arsenic—1,205,110 lbs. in weight and $41,483 in value.

Dividends.—Up to the end of the year the dividends returned to shareholders of companies operating silver mines in the Cobalt area had reached a total of 57 million dollars. For the year itself they amounted to about $6,700,000. Two gold mining companies—Hollinger and Porcupine Crown—paid out or declared $1,350,000, a total for silver and gold companies in 1914 of $8,050,000. Profits earned in nickel, construction materials, and other products will increase this sum by five or six million dollars at least, so that even in times marked by so great a calamity as a war in which the future, not only of the British Empire but of civilization itself is at stake, it is a tribute to the substantial character of Ontario mining that a reasonably good return continues to be made.

Water Power.—The principal mining camps now depend almost entirely upon water power for operating their mines and machinery. In Porcupine, Sudbury, Michipicoten, Kirkland Lake and elsewhere the energy is delivered in the form of electric current. In Cobalt it comes also as compressed air. The source in all cases is the falling of water on near-by rivers, and the cost of power is much less than when generated by the burning of coal or wood—averaging probably not more than one-third the price of the latter. The precipitation of moisture in 1914, however, was much less than usual, and the consequence was that when the season of low water came on in January and February, 1915, operations were curtailed by lack of power. Building plants at Cobalt were obliged to close down one week in four, and this will tend to diminish the output of silver for the present year.

Legislation.—Two legislative enactments came into force, one on 1st January, 1914, and the other a year later, affecting the mining industry. The first was the law prohibiting underground labor for more than eight hours out of the twenty-four. This was accepted by the mining community as a whole with little dissent, and is now a recognized part of mining routine. The second was the Workmen's Compensation Act, which covers all other industrial operations as well as mining. Necessarily the first year's experience with this measure will be more or less tentative, but the machinery provided for its administration will enable satisfactory adjustments to be made. One result is certain—the relations between capital and labor will no longer be distributed by a system under which the employer was often made the unwilling instrument in denying justice when an employee was killed or injured, and which too frequently led to the still further impoverishment of the victim or his beneficiary by ill-advised and expensive litigation.

MINERAL PRODUCTION OF QUEBEC, 1914

By Theo. Denis, Superintendent of Mines.

(The figures for 1914 are subject to revision.)

The total mineral production of the Province of Quebec for the year 1914 amounted to $11,325,428. As compared with 1913, this is a decrease of $1,794,383. For the first time in twelve years, we are unable to record an increase in yield over the previous year. And, in fact, it is a matter for gratification that the figures have not fallen off more than this 13.7 per cent. decrease.

The first six months of 1914 augured well for a record-breaking year, and it is due to the activity which prevailed until the end of July that our decrease of production, as compared with the previous year, is not greater. But soon after the opening of hostilities in Europe, the disturbed industrial conditions began to be felt by our mining industry.

As in the past, the figures given in the accompanying table for 1914 are provisional. They are subject to revision as, at this date, some dilatory producers have not yet complied with the regulations concerning sending their report of production. However, the preliminary figures are usually well within two per cent. of the revised figures. These will be given in the final report, ready for distribution to the public in May.

The last column of the general table of production gives the revised figures for 1913, for the purposes of comparison. Moreover, the following figures show the progress of the mineral industry in Quebec since 1902:

	Value of Mineral production
1902	$ 2,985,463
1903	2,772,762
1904	3,023,568
1905	3,750,300
1906	5,019,932
1907	5,391,368
1908	5,458,998
1909	5,552,062
1910	7,323,281
1911	8,679,786
1912	11,187,110
1913	13,119,811
1914	11,325,428

Asbestos.

The shipments of asbestos during the first six months of the year were in excess of the corresponding period in 1913. But during the last five months, the conditions of the market compelled most of the producers to practically discontinue operations or decrease them to a fraction of what they would have been under normal conditions. Germany was an important consumer of our asbestos, much more so than appears from the tables of export figures, for most of the exports to Belgium went to Antwerp in transit to German consumers. This, however, is in the way of being remedied. Since the early part of January, activity has been apparent in the Thetford district, and important shipments are now being made, particularly to the United States. It looks as if the South American trade of manufactured asbestos products, which was in a great measure monopolized by Germany, were being taken up by American manufacturers.

The short tables which follow give an analysis of the asbestos mining industry in 1914 and 1913:

Production of Asbestos for 1914.

	Shipments.			Stock on hand	
Designation of Grade.	Tons.	Value	Average value per ton	Tons	Value
Crude No. 1	1,336	$402,417	$301.96	985	$301,237
Crude No. 2	2,812	370,776	131.85	1,345	187,688
Mill Stock No. 1	10,485	633,289	60.40	2,737	166,761
Mill Stock No. 2	32,847	818,765	24.93	9,757	231,874
Mill Stock No. 3	59,921	670,688	11.18	16,968	204,429
Totals	107,401	2,895,935	26.96	31,792	1,091,989
Asbestic	13,251	4,904			
	120,652	2,900,839			

Quantity of rock mined during year 1914: 2,127,395 tons.

Table of Mineral Production of the Province of Quebec in 1914.

	Production 1914		Value in
Substance.	Quantity	Value.	1913.
Asbestos, tons	107,401	$2,895,935	$3,830,504
Asbestic, tons	13,251	4,904	20,346
Chromite, tons	135	1,210	....
Copper and sulphur ore, tons.	117,778	801,129	812,899
Feldspar, tons	98	2,156	1,554
Gold, oz.	996	21,084	14,794
Graphite and magnesite, tons.	619	21,126	12,955
Iron ore, titaniferous, tons...	....	....	9,824
Kaolin, tons	1,000	9,000	4,354
Magnesite, see graphite, tons	....	....	....
Mica, lbs.	423,821	55,636	117,038
Mineral waters, gals.	56,068	15,582	31,728
Mineral paint, (ochre), tons.	5,690	36,600	40,868
Phosphate, tons	635	5,057	3,506
Quartz, tons	200	525	2,363
Silver, oz.	57,426	31,809	21,791
Zinc and lead ores, tons	969	15,490	7,370
Structural Materials—			
Brick, M.	136,885	1,093,731	1,297,592
Cement, bbls.	2,840,436	3,325,055	3,361,292
Granite	....	561,900	496,588
Lime, tons	53,728	383,927	464,424
Limestone and marble	....	1,566,145	1,824,748
Phonolith	626	2,114	
Sand	....	336,853	405,750
Sandstone	....	....	5,072
Slate, square	1,071	5,105	6,286
Tile, drain and sewer pipe, pottery, etc.	....	133,355	326,165
		$11,325,428	$13,119,811

Copper and Sulphur Ores.

Returns have been received from four producers of copper and sulphur ores, all in the Eastern Townships. Both the Eustis Mining Company and the Weedon Mining Company (McDonald mine at Weedon) have shipped actively, and, moreover, have done much blocking out work with excellent results. Sub-

stantial shipments from development work have also been made from a promising prospect at Stratford, near Weedon, and from the Ives mine at Eastman.

Gold and Silver.

Most of the production of gold and silver can be ascribed to the small values in the metals contained in the copper-sulphur ores of the Eastern Townships. But a certain proportion results from work on the Beauce alluvial deposits, where individual miners worked on a royalty basis, paid to the "Champs d'Or Rigaud-Vaudreuil," the present owners of the mining rights on the Rigaud-Vaudreuil Seigniory.

Mica.

The mica industry appears to have suffered considerably from the industrial disturbances. Our total production fell much below the previous year's, and lower prices prevailed.

In previous years, the mica industry in the Province of Quebec was practically confined to the region of the Gatineau and Lievre district, but in 1914, substantial quantities of an excellent mica were shipped from a mine situated some eighteen miles below the city of Quebec, at Petit Pre, about two miles inland from the St. Lawrence.

Iron Ores.

We have to record complete inactivity in the iron and iron ore industry of Quebec. For the past two or three years iron mining has been limited to titaniferous iron ores, which were used in the manufacture of ferro-titanium, but in 1914, none was shipped.

Building Materials.

There is a decrease to record in the total value of the building materials. This is to be expected in times of unsettled industrial conditions and financial stringency. In fact, considering the conditions which have prevailed since the middle of the year 1914, it is a matter of congratulation that our building materials industry did not suffer more than it did.

Other Products.

Numerous enquiries have been received regarding the possibility of various products which are known to occur in the province, but which, so far, have not been worked or have been worked only on a limited scale. Such are, molybdenite, magnesite, feldspar as a source of potash. This has been due to the fact that the European hostilities cut off a very large proportion of the sources of supply of these substances. Magnesite was produced in large quantities by Austria, and the main source of potash is the German deposits. As feldspar (orthoclase) contains nearly 17 per cent. potash, it is quite natural that attempts to utilize this should be made.

Accidents.

During the calendar year 1914, an average of 6,756 men were employed in the mines, quarries, mills and concentrators in the Province of Quebec, as compared with 8,611 during 1913. The total amount of wages paid was $4,138,059.

In 1914, reports were made to the Mines Branch of 133 accidents, of which 9 were fatal. This gives a ratio of 1.33 deaths per 1,000 men employed. In 1914, we recorded 16 fatal issues out of 197 accidents, or a ratio of 1.86 per 1,000.

There were no fatal accidents in quarries in 1914. The accidents resulting in deaths of men all occurred in mines, which employed 3,116 men, giving 2.84 fatalities per 1,000 men, as compared with 3.19 per 1,000 during the previous year.

PERSONAL AND GENERAL

Mr. E. Dedolph, of Nelson, B.C., who for a comparatively long time was engaged in connection with the experiments in electric smelting of lead-zinc ores conducted by the Dominion Department of Mines, has been commissioned to report on the ore of the Cork-Province mine on the South Fork of the Kaslo river, in Ainsworth mining division of British Columbia, with the object of determining the most suitable method of treatment to recover the zinc and lead contained in that ore.

Mr. W. J. Elmendorf, for several years employed in directing the mining work near Stewart of the Portland Canal Mining Co., and later of the Portland Canal Tunnels, Ltd., has opened an office, as consulting mining engineer, at Seattle, Washington.

Mr. Charles Graham, manager of the Corbin colliery, in Southeastern Kootenay, British Columbia, has been ill with inflammatory rheumatism.

Mr. J. Cleveland Haas, connected with mining development in the Boundary district of British Columbia, has returned to Spokane, Washington, after having spent some months on a placer gold property in Montana.

Mr. G. H. Kirkpatrick, of Vancouver, who for some time was associated with the Messrs. Leckie at Vancouver, B.C., is now Lieutenant-Colonel in command of the 11th Canadian Mounted Rifles, in British Columbia.

Mr. Andrew G. Larson, of Vancouver, was one of several mining engineers from British Columbia who attended the Northwest Mining Convention held last month in Spokane, Washington.

Mr. F. Chas. Merry recently left Kaslo, B.C., for Utah, U.S.A., after having spent several years as superintendent of silver-lead mines in the Lardeau district of British Columbia.

Mr. John L. Retallack, who last month went from West Kootenay to Victoria, B.C., was convalescent at the end of February, after having been in a hospital three weeks suffering from a severe attack of la grippe.

Mr. Lewis Stockett has returned to Calgary, Alberta, from a visit to Vancouver Island, British Columbia.

Mr. S. W. Cohen is in Nicaragua examining a gold property for the Crown Reserve Mining Company.

Mr. G. G. S. Lindsey, who has been in England for the past few weeks, has been re-elected president of the Canadian Mining Institute. It is understood that he will leave for China shortly after his return from England.

Mr. W. G. McIntosh has recently been appointed sales engineer for Toronto by the Herbert Morris Crane and Hoist Co., Ltd. Mr. McIntosh is a graduate in mechanical engineering, University of Toronto, and has been connected with the Otis-Fensom Co., Toronto Power Co., Canada Foundry Co. and Dominion Bridge Co.

Ricketts & Banks, mining, metallurgical and chemical engineers, New York city, announce the termination, March 1, of the co-partnership existing between Pierre de P. Ricketts and John H. Banks for the past 40 years. Dr. Ricketts will remain at 80 Maiden Lane and Dr. Banks is located at 61 Broadway.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

The estimates of revenue from the mining industry of the province for the ensuing fiscal year, as stated by the Minister of Finance in his budget speech delivered before the Legislative Assembly of British Columbia at the end of February, appear to be conservative, almost to the extreme of caution. They show a total of only $341,500 as compared with the actual receipts for the fiscal year 1912-13 of $658,725. Particulars follow, the figures in parentheses being amounts received for the last mentioned fiscal year: From free miners' certificates, $50,000 ($62,986); mining receipts, general, $50,000 ($94,754); mineral tax, $100,000 ($155,163); royalty and tax on coal and coke, $100,000 ($302,225); unworked Crown-granted mineral claims, $40 000 ($42,734); Bureau of Mines, $1,500 ($863). It will be seen that of the estimated decrease, as compared with the year of highest total annual value of mineral production in the history of mining in the province, nearly two-thirds is on revenue from coal and coke. It may easily happen that receipts will be larger than estimated, and, too, with the outlook for the production of metalliferous minerals gradually improving, it is not unreasonable to look for more revenue from both general mining receipts and the mineral tax than the amounts estimated.

East Kootenay.

Sullivan Group—Receipts of lead ore from this mine at Trail during four weeks ended February 25, totalled 3,231 tons, an average of 808 tons a week, compared with 2,654 tons during four weeks ended January 28, for which latter period the weekly average was 663 tons. For eight weeks the total was 5,885 tons and the weekly average over that period 736 tons.

Agreement with Coal Miners.—At a coal miners' convention sitting at Lethbridge, Alberta, on several days in the latter part of February the question of a new agreement with the Western Coal Operators' Association was discussed. The current agreement will expire at the end of March, and no secret has been made of the intention of the United Mine Workers of America to endeavor to secure advantages for the miners not enjoyed by them under the existing agreement. There seems, however, to be a general recognition of the fact that it is most unlikely, under present unfavorable conditions and the unpromising outlook for any considerable improvement for some time to come, the operators will concede an increase in rates of pay, and the opinion has been freely expressed that the miners will not strike. There will, however, be made strong efforts to induce the operators to meet certain of the requirements of the miners that their representatives consider them fairly entitled to. The U. M. W. of A., District No. 18 includes the Crowsnest section of Southeast Kootenay.

West Kootenay.

Slocan—At the annual general meeting of the Star Mining and Milling Co., held recently in Sandon, a resolution was passed as follows: "Whereas there are no apparent benefits to be gained by the continuation of this company, therefore be it resolved that this company be wound up voluntarily." The Star company was plaintiff in the lateral rights litigation that for several years seriously hampered the further development of the Slocan Star mine and which, after the close of long and costly trials before British Columbia courts of law, eventually ended in an amalgamation of the properties concerning which there had been very much trouble with little or no material advantage to either side, and which are now owned and being operated by the Slocan Star Mines, Ltd. A meeting has been called to confirm the above quoted winding-up resolution, and thereafter there will disappear from the memory of the general public the plaintiff in the famous "Star vs. Byron White" case which finally left those chiefly concerned, on both sides, sadder and wiser, and, too, poorer men. A very large amount of money was wasted in litigation, and lawyers and expert witnesses benefited largely therefrom.

From New Denver has come the news that the lessee of the Molly Hughes mine, situated near that town, has encountered a narrow vein of high-grade ore in the course of the development work he has been doing lately. The "Slocan Record" also publishes the report that the Standard Silver-Lead Mining Co.'s concentrating mill at Silverton is soon to be again operated at full capacity, the reason being suggested that the action of the Slocan Board of Trade supported by the efforts of the Dominion member for Kootenay, Mr. R. F. Green, M.P., has resulted in a modification of the smeltery charges or terms in connection with the reduction of silver-lead ore and concentrate from Slocan district mines. As during eight weeks ended February 25th there was received at the Trail smeltery only 690 tons of ore and concentrate from Slocan mines, of which 444 tons was from the Rambler-Cariboo and the remainder from five other properties, it is evident, with much ore available for shipment, that conditions have not of late been favorable to production at a profit, otherwise there would have been a larger output. However, it is hoped that market conditions will soon admit of the disposal of silver and lead to advantage so as not to leave the smelting company to carry the heavy burden of holding a very large quantity of unsaleable metals and the accompanying financial loss involved by the continuance of such an unusual market condition.

Nelson—The "Daily News" has published the balance sheet of the French Complex Ore Reduction Co., Ltd., as at November 30, 1914, which had been filed with the Registrar of Joint Stock Companies for British Columbia, as follows: Liabilities—Capital authorized, $20,000. Capital paid up, $18,950; share premiums, less unpaid, $10,850; salaries outstanding, $44.90; creditors, sundry persons, $29.90; total, $29,874.80. Assets—Ore treatment franchise, $28,165.06; stocks and shares, $1; sundry debtors, $15.15; cash at bank, $1,693.59; total $29,874.80. The company had for several years made Nelson the headquarters for its experiments in the reduction of lead-zinc ores, under the direction of Mr. A. Gordon French. Last month it was announced that Mr. French was about to leave Nelson for England.

Information concerning the Northwest Mining Convention, published in Nelson on February 25, gave the following particulars: The annual Northwest Mining Convention now being held in Spokane, Washington, is proving a decided success and is being attended by a considerable number of mining men from Kootenay

and Boundary districts and other parts of British Columbia. Exhibits are on display at the convention from practically every mining camp in British Columbia, as well as from those of the northwestern portion of the United States, and these exhibits are attracting considerable attention. From the Kootenay and Boundary districts there are also being shown excellent exhibits of the products of the Consolidated Mining and Smelting Co. and the French Complex Ore Reduction Co. Prominence is given in the display to ores from Nelson, Ainsworth, Kaslo, Slocan, and Rossland. It is stated that the convention is proving the greatest success of any movement for the advancement of the mining industry held in the Northwest in the last ten years.

Rossland—The "Rossland Miner," in its issue of February 20, gave much prominence to the subject of a "War Tax Call Made on Big Four Shareholders," concerning which it said, in part: "The knowledge that the promoters of the Big Four Consolidated Gold Mines, Limited, have resumed activity is a piece of news that will bring anything but satisfaction to residents of this district and others who are also interested in its welfare. This activity takes the form of circulars, signed by James Lawler, secretary, mailed from Vancouver to shareholders of the company, calling for the payment of assessments, styled by the persistent originator of the enterprise as 'Emergency War Tax Calls.'

"The people of Rossland and district know how much value to attach to anything that James Lawler undertakes, and to either the possibilities or intentions of the Big Four Company. Unfortunately people outside may not know this, the result being that trading upon the good name of this camp, made especially conspicuous by prosperity in the midst of country-wide adverse conditions, the uninformed public is gulled of its savings, which, on being transferred to the treasury of the Big Four Consolidated Gold Mines, Limited, are not likely to accomplish any desirable development of temporary or lasting good to mining at Rossland.

"The whole proposition needs no elaboration, as far as Rossland people are concerned, to ensure their treatment of it in the way that it deserves. But it should be given the widest publicity possible for the sake of the innocent shareholder, uninformed as to conditions, and for the sake of the good name that the camp has attained. It was concerns of the Big Four character that surrounded all Rossland mining development with suspicion a few years ago. Now that the stigma has been lived down, and mining here has been placed on a basis of absolute stability, this good name should be so jealously guarded that all attempts made by James Lawler and similar enemies of progress should be throttled instantaneously and finally."

The "Miner" points out misstatements in the circulars (which it reprints in full) and adds that "informed people state that the property has been idle from ten to fourteen years," also a caution to those likely to be misled by the circulars. The Nelson "Daily News" has also printed in its editorial columns a lengthy notice of the circulars of the secretary of the Big Four company, and closes it comments with the following paragraph: "Rossland is a flourishing mining section which has been placed on a prosperous and stable footing by sound mining methods. Every effort should be made to stop any attempt to trade upon the reputation of the camp to forward any purpose that will not stand the most searching investigation."

The output of ore from the Rossland mines of the Consolidated Mining and Smelting Co. and the Le Roi No. 2, Ltd., is being maintained at well on for 7,000 tons a week. A report from Spokane was to the effect that six men left that city on February 24th for Rossland to commence unwatering and repairing the Blue Bird mine, in the South Belt, preparatory to its being examined with the object of determining what work shall be undertaken under the lease of the property held by Mr. E. L. Tate, of Spokane.

Boundary.

News notes published by the Greenwood "Ledger" indicate that work is again being done on a number of mineral claims in that part of Boundary district. The E. P. U. shipped a carload of gold ore early in February. The Prince Henry, another gold claim situated near the town, has been leased. The Argo company has bonded the Dynamo claim, which is adjacent to the property on which the Argo tunnel has been driven. Ore has been taken out recently from the Strathmore, situated above the 3,000-ft. crosscut adit driven by the Greenwood-Phoenix Tramway Co. Mining and ore-crushing are being continued by the Jewel-Denero Co., which is steadily maintaining its output of gold-silver ore. The Granby Co. is making an output of more than 2,000 tons of ore a day from its mines at Phoenix.

COBALT, GOWGANDA AND SOUTH LORRAIN

Very few members of the Canadian Mining Institute went down to the annual meeting from Cobalt, Porcupine and subsidiary camps. The reason for this is that while conditions are not bad relatively they are so positively in comparison with last year. And considering the importance of the Cobalt and the Porcupine fields there were not many papers directly affecting these camps. The one by Mr. Thornhill, superintendent of the Buffalo mill, on the method he has perfected for saving and refining mercury from high grade ore residue was listened to with a good deal of interest. The paper by Mr. Cunningham, late of the Hollinger mill, now of New York, was printed in the proceedings, but not read. These were all the papers that directly related to the Cobalt and Porcupine camps, although the discussion on the stimulation of prospecting was of great interest to everyone in the north.

A noteworthy feature of Mr. Gibson's summary of the mineral production of the province was that the gold industry was the only item in the list that showed any gain. This, Mr. Gibson stated, was almost entirely due to the development of Porcupine.

The great advance in the insurance rate of silver bullion to London more than offsets the advance in the price of silver. Before the war the express charge on bullion was $6.50 on $1,000 and 75 cents for insurance. The insurance rate was raised to $1.80 when the war commenced, but dropped back to the old price on the assurance of protection by the Imperial government. Since the disturbed conditions commenced in the Irish Sea it has been raised to the unprecedented amount of $10 per $1,000 for insurance alone, which is prohibitive and will undoubtedly lead to a restriction in the silver output. This is the more likely to be the case since it is not likely that this rate will long be maintained. The mine owners will the less bewail their inability to ship direct if the tendency for silver to rise continues.

No doubt much silver bullion will be diverted to New York, but experience has shown since the war started that in spite of war conditions London is still the silver bullion market for the world and the bulk

of the white metal must find its way there eventually. There is no restriction in the ore shipments so that there does not appear to be any great cause for alarm in the sudden rise of the insurance rates.

When the official figures for the silver output for the first quarter of the year are published it will undoubtedly be found that there has been a very notable falling off. Any criticism based on this of the sudden caving in of the camp will not, however, be on a sound basis. During the past first quarter the output has been arbitrarily curtailed by the shortage of power which has shut down all the mills in rotation for a quarter of their time every month. The low price of silver has not been conducive to feverish exertions to produce to the maximum and now the excessive insurance rates will again cause a diminution of the shipments.

Nipissing.—During the month of February the Nipissing mine shipped ore of an estimated net value of only $164,140, and shipped bullion from Nipissing and customs ore of a net value of $183,646. The company explains the short production as follows: "Owing to the shortage of electrical power it was necessary to close down the low grade mill during the last week of the month, which also meant the closing down of the washing plant. The production for the month therefore represents three weeks instead of the usual four."

Of the $164,140 produced only $57,194 came from the low grade mill for this reason.

Raises on one of the branch veins from the fourth level at shaft 73 produced good results. At the beginning of the month the raise had been put up 62 ft., over which distance the vein averaged two inches of 2,000 oz. ore. For about 30 ft. it averaged 2,500 oz. for three in. During the month the vein was raised on for 101 ft., and while not so wide or so high grade it was quite satisfactory. But at the fourth level further drifting on the vein encountered a fault beyond which the ore has not yet been picked up.

Crosscutting into new territory was carried on at five different places on the fourth level. One of these crosscuts encountered what is believed to be an extension of vein 64. It was cut about 200 ft. to the east and the same depth as where the vein was last developed from a winze. The vein is low in silver and only about an inch wide. The crosscut is being extended in order to endeavor to pick up an ore shoot or a parallel vein.

Interesting prospecting is in progress on several calcite veins carrying some cobalt but no silver of any importance.

Results are still not encouraging on the 1,000 ft. level of vein 64, and it is not improbable that operations there may be shortly discontinued.

Temiskaming and Beaver—Good results continue to be met with at the Temiskaming and Beaver mines. Just one week before the annual meeting it was learned that a vein of very high grade ore had been found at the back of the old stopes in the upper levels of the Temiskaming. The grade is similar to that which has made the Temiskaming famous. The week before the annual meeting also a carload of ore was shipped from the new development which will probably bring back to the company from the smelters about $90,000. On the main vein system itself the grade and the width are still satisfactory. The ore is wider in the face than it has been for some time, and the ore shoot is now about a hundred feet in Temiskaming territory alone.

Silver Leaf.—The discovery on the Silver Leaf property is still holding good in the winze. It is in fact at the bottom of the winze wider and of higher grade than when it was first struck. Work by the Crown Reserve mining company is actively proceeding on it.

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

The shortage of power has now spread to the Porcupine camp and all mines but the Dome and Hollinger have had to curtail their activities very materially. There was a good deal more rainfall in the Mattagami River watershed than south of the height of land and the power company hoped that it might be possible to tide over an exceptional year without any great inconvenience to the companies concerned. But the drought was too severe, and while it has been thawing in the daytime, it has been freezing at night and little water is going over the dams. In consequence of the situation the Northern Canada Power company had to give notice that after March 1st they would be compelled to cut off half the power from all mines but the Dome and the Hollinger. These two mines were parties to the power consolidation in the camp and were then granted special privileges. It is probable that some arrangement may be made which may be more equitable to the smaller companies and at the same time not prove of much inconvenience to the Dome and the Hollinger.

As it is the Porcupine Crown, the McIntyre, the Vipond and the Dome Lake have been obliged to curtail operations very considerably. This state of affairs should not continue after the middle of April. Two years ago any shortage of power would have been considered most unlikely, it then being considered that the camp would never need all that had been developed. But the tremendous strides of the Hollinger in development has overthrown all calculations. Most of the mines in the Porcupine camp have subsidiary steam plants; but most of them are quite inadequate to their present requirements, and with the high price of coal the companies are naturally very reluctant to revert to steam unless under compulsion.

Teck-Hughes.—The decision of the Nipissing mining company to throw up their option on the Teck-Hughes caused a good deal of surprise in the district. It was believed that while the development had not been spectacular it had been steady and that substantial progress had been made. It was also thought that the Nipissing had secured the option on such terms as would enable them to take further chances with the property. The ore zone at the 300 ft. level was 12 ft. wide; but most of this width only yielded two dollar ore. The property has been turned over to the Great Northern Silver Mines and the pumps have been pulled up.

Dome.—It is reported that some ore, much above the usual grade has been struck and is now being mined at the 600 ft. level of the Dome mines. It is most probable that ore will be raised to the surface at the No. 2 shaft and hauled on the surface by electric motors and trucks to the rock house. This will be in addition to the ore that is being hauled up the incline from the 100 ft. level.

Taylor Claim.—Some very spectacular ore is being obtained in hand samples from the Taylor claim in Munro township. The ore is very rich. The Taylor claim adjoins the Dobie, upon which the first discovery of importance was made in this field. There may probably be a little activity in claims in this section.

CALUMET AND HECLA.

Never before in the history of Lake Superior copper has there been such insistent demand for immediate shipment at this season of the year. As a rule local smelters begin to accumulate refined copper in March, to hold until navigation opens, to take advantage of water freight rate. But now smelters are shipping daily to New York, and 200,000 lb. left in one shipment from the Calumet and Hecla smelter following a shipment of 300,000 lb. the day before. Report has it that this company is selling direct to the French Government.

According to a recent despatch Calumet and Hecla has raised its price for Lake copper to 15⅜ cents a lb. and is understood to have booked sales at that level. Other Lake brands range down to 14¾ cents a lb.

Fair domestic demand for electrolytic copper has developed with sales at 14¾ cents a lb., but the demand for Lake grades other than "C. & H." has been light. Michigan producers state that they have sold practically no copper for the past week.

The premium commanded by Calumet & Hecla over the electrolytic price of 14¾ cents establishes the widest spread ever known between the two brands. Ordinarily this spread varies from ⅛ to ¼ cent per lb.

HILLCREST COLLIERIES.

Montreal, March 6, 1915.

Net profits of $92,764 for the year ending December 31, 1914, a decrease of $32,312 as compared with the previous year, were reported at the annual meeting of the Hillcrest Collieries, Limited, held in Montreal on Tuesday last. The general curtailment of business during the year affected the company's output to a large extent, as was pointed out at the meeting of shareholders by President C. B. Gordon. In addition, of course, the company suffered considerably from the explosion of June 19 last, although the property loss was small when compared with the loss of actual life. A foot note to the annual statement, by the auditors, sets forth that all replacements of plant necessitated by the explosion at the mine have been charged against revenue. Presumably, therefore, the shrinkage in earnings may be attributed in part to the replacement of plant, as well as to the curtailment of business.

At the present time the directors of Hillcrest find it impossible to compute their liability in respect to the accident of last June, in spite of the fact that various independent estimates have been made. It appears that a large majority of the employees killed in the explosion were foreigners—a large number of them being Austrians.

Under existing conditions it is impossible to recognize claims on behalf of the families of aliens, even if such claims were made. Acting in accordance with the custom in Alberta, however, the company is paying compensation for beneficiaries into the District Court, which pays it out in monthly instalments to the proper claimants. The arrangement between the company and the District Court calls for the payment by the company of a sum of $3,000 per month until full liability has been liquidated—said full liability being impossible of computation at the present time, as already indicated.—Financial Times.

TECK-HUGHES.

Cobalt, Ont., March 3.

Owing to the fact that the ore shoot on the 300 ft. level of the Teck-Hughes suddenly pinched out, the Nipissing Mining Company has abandoned its option on that property.

The zone of enrichment at the 300 ft. level was 12 ft. wide, but two-thirds of this width ran very low in gold contents, although the vein proper was as rich as the average grade of the Kirkland Lake ore.

The Nipissing took up the option on the understanding that they would buy control at the rate of 15 cents a share in the two million dollar company. They were to arrive at a final decision in August. Each month a certain amount of money had to be spent in development, which was to be returned to them in stock.

The deal was made with the Great Northern Silver Mines, which has control of the Teck-Hughes stock. The Great Northern is not in a position to finance operations itself, so that if the mine is again worked it will have to be by some other company. In the district the mine was regarded as quite promising, and its closing down was a surprise.—Journal of Commerce.

SLICK MINE TIES.

The Cambria Steel Co. has issued a pamphlet on Slick mine ties, for mine and industrial railroads. The Slick mine tie is the result of study and experiment to produce a metal cross tie for mine and industrial railroads, that will prove of distinct advantage in use and meet the needs of mines, mills, quarries, contractors and others who are desirous of using a satisfactory substitute for wooden ties, which latter are no longer conveniently available in good quantity at reasonable prices.

AGITATORS WARNED.

Houghton—The biggest Finnish demonstration in the history of Northern Michigan was held at Calumet last week, and labor agitators and red socialists were given formal notification to leave Calumet or be run out of town. The Calumet armory was packed to its doors at mass meeting, following a big parade. The speeches were all in the Finnish language, and were by miners, except one which was made by John Doelle, superintendent of the Houghton public schools, who advocated the deportation of the red agitators "by fair means if possible; and otherwise, if necessary."

LE ROI NO. 2, LIMITED.

Josie Mine Report for January—Shipped, 1,082 tons of ore and 76 tons of concentrates. The receipts from smelter are $16,548, being payment for 989 tons ore shipped and $1,354, being payment for 102 tons concentrates shipped. Sundries, $973. Total, $18,875.

Estimated working costs for corresponding period—Ore produciton $5,500, milling $625, development, $3,250.

LA ROSE.

La Rose Consolidated Mines declared a quarterly dividend of 1 per cent., payable April 20 to stock of record March 31. Previous rate was 2½ per cent. quarterly.

FELDSPAR AS A POSSIBLE SOURCE OF POTASH*

By Allerton S. Cushman and Geo. W. Coggeshall.

Muriate of potash is the chief potash salt imported in America. It is sold on the basis of "80 per cent. muriate," and usually contains from 70 to 80 per cent. KCl, or from 44 to 50 per cent. K_2O. This material, having its values in such a small bulk, will bear the cost of freight shipment easily. It is the cheapest potash sold for use as a raw material for chemical manufacturing, and it is also well adapted for mixing into general commercial fertilizers. Any potash salt, however, running not less than 17 per cent. K_2O (or 26 per cent. KCl) is adapted for use in mixed fertilizers. A salt lower than 17 per cent. K_2O could only be used where the final K_2O content in the complete fertilizer was to be less than 5 per cent.

Therefore, for the uses of the fertilizer industry, the economical production of any material containing 26 per cent. or higher of KCl, would find large use, but for the replacement of all or a portion of the one million dollars' worth of concentrated muriate salts used yearly in the United States for chemical manufacturing, it is necessary to produce a salt containing at least about 70 per cent. KCl.

A comparatively small quarry of feldspar, containing 1,000,000 cu. ft. of rock, or 100 ft. in cube, would contain 17,000,000 lb. of potash (K_2O) which, if it could be extracted, would be worth even at ante-bellum prices, $700,000. One ton of such an ore would contain 200 lb. of potash, worth, if it could all be extracted, about $7. If we assume, however, that only 75 per cent. of it would yield to a chemical engineering process, we still have $5 per ton in value to work for. When we remember that in large scale operations in the gold mining industries, quartz that carries no more than $2 per ton in valuable constituents has been profitably worked, the problem need not necessarily frighten us away at the outset.

During the fiscal year ending June 30, 1914, there was imported into the United States $15,000,000 worth of potash salts, kainit, manure salts, muriate of potash, and sulphate of potash. In addition to this, considerable quantities of caustic and carbonate of potash, not included in the later available statistics, were also imported. Of the total, $8,000,000 worth was muriate of potash. The fertilizer industry uses, of course, the larger proportion of these potash importations, the percentage in the last few years being about 85 per cent. of the total of muriate of potash imported, there being left about $1,000,000 worth of muriate of potash which was used in industrial work. About half of this total, or $500,000 worth, was used to make caustic potash and carbonate of potash. These are used principally in the soap industries, although a large portion is used as a wrapper-tobacco fertilizer and in the manufacture of glass, paper, preparation of colors, in printing, in photography and in more strictly chemical industries. Some nitrate of potash is manufactured from the chloride. About one-eighth of the muriate is manufactured into chlorate of potash at present, which is largely used in the growing safety-match industry. Potash bichromate uses about one-twentieth of the muriate and this is used in textile and color industries, also in photography.

A process for the production from feldspar of potassium chloride salts similar to the concentrated muriates imported from Europe is as follows:

A mixture of ground feldspar, containing about 10 per cent. of K_2O, and burned limestone, is formed into rounded aggregates or "clumps" about ¼ in. in diameter, using a solution of calcium chloride for this purpose. Calcium chloride is the by-product of the ammonia-soda alkali process and is the reactive agent in unlocking the potash from the silica. It was found that a proportion of burned lime mixed with the powdered feldspar will unite with $CaCl_2$ from a solution sprinkled on the powder, to form an oxychloride compound which cements the whole powder into aggregates, giving such a very intimate union of the particles that when heated the reaction yields are high. These aggregates or "clumps" pass directly into the rotary kiln heated either by oil or powdered coal flame. The clumps fall out of the kiln in the same form in which they entered it, but the potash has been converted from the insoluble form into the water-soluble muriate. These red-hot clumps fall into water in leaching vats, where the potassium chloride goes into solution. Several of these leaching vats are used so that the solution of the salt, the leaching, washing, etc., is continually performed. The strong solutions are pumped to the evaporators. The weaker wash liquors are used as leaching liquids for a new lot of processed clumps. The strong liquor containing roughly 10 per cent. of KCl will be continuously sprayed down through the hot gases passing out of the kilns to the stacks. This operation is well known and has been studied particularly by our engineers.

The bulk of the water in these solutions is thus evaporated and only very concentrated solutions or sludges are allowed to pass out. These very strong hot liquors are finally dried out in a rotary dryer placed at the head of the lime-burning kiln, using its hot waste gases. The crusts formed are then ground for the market.

The concentrated solution before complete drying contains a small proportion of sodium chloride, corresponding in amount to the proportion of Na_2O in the original feldspar. On a spar running 10 per cent. K_2O the Na_2O content has averaged from 1½ to 2 per cent. This would give from the liquors completely dried at once, without any fractional separation of the NaCl, a product having about the following composition: KCl, 70 to 80 per cent.; NaCl, 14 to 16 per cent., and the balance a very small amount of lime salt and moisture. It is thus seen that without any attempt at fractional separation, muriate of potash, equal in character to the usual imported muriates, may be made from American feldspars.

If the hot concentrated liquors are not at once brought to dryness, but are given a fractional crystallization treatment, which may be made a continuous operation, whereby most of the NaCl is removed, the KCl crystals then obtained will run pure enough to enable their direct use in the manufacture of chemicals of a high grade of purity.

The plant required is equipped in a general way similarly to a Portland cement mill. There must be rock hoists, trackage, crushers, rolls, rock dryers, grinding mills, a rotary lime burner, the "clumpers" and rotary kilns, coal dryer and grinder, besides bins, elevators and conveyors, also leaching vats, tanks for strong liquors and for wash water, pumps, flue arrangements at stack for spraying the liquors, dryers and pulverizer, also air compressor and general power plant, stairs, ladders, handrails and buildings to house the plant.

*Extracts from a paper read before the American Institute of Chemical Engineers, at the Philadelphia meeting on December 2, 1914.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

March 8, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	.30⅝	.30⅞
British Copper	.17¼	.17¾
Braden Copper	.06¾	.06⅞
Chino Copper	.36½	.36⅝
Giroux Copper	.00¼	.01
Green Can.	.27	.28
Granby	.68	.68¾
Miami Copper	.20	.20⅛
Nevada Copper	.12⅞	.13
Ohio Oil	131.00	133.00
Ray Cons. Copper	.17¼	.17½
Standard Oil of N. Y.	191.00	192.00
Standard Oil of N. J.	393.00	395.00
Standard Oil (subs)	800.00	.....
Standard Oil (old)	1200.00	.....
Tonopah Mining	.07⅝	.07⅞
Tonopah Belmont	.04¾	.05
Tonopah Merger	.40	.42
Inspiration Copper	.20¼	.20½
Goldfield Cons.	.01⅝	.01$\frac{11}{16}$
Yukon Gold	.02⅝	.02¾

Porcupine Stocks.

	Bid.	Ask.
Apex	.02	.02⅞
Dome Extension	.05¼	.05⅞
Dome Lake	.22¼	.23
Dome Mines	6.60	6.90
Foley O'Brien	.17	.20
Hollinger	22.60	22.75
Jupiter	.09	.09⅛
McIntyre	.30	.31
Pearl Lake	.01½	.01¾
Porcupine Gold	...	.00⅝
Imperial	.01½	.02¼
Preston East Dome	.01¼	.02
Rea	.12	...
West Dome	...	.09
Vipond	.36	.36½
Porcupine Pet	...	.20
Teck Hughes	.05¾	.06½

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02⅛	.02¼
Beaver	.26¾	.27
Buffalo	.65	.95
Chambers Ferland	.11¾	.15
Coniagas	4.25	4.40
Crown Reserve	.84	.90
Foster	.02	...
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Gould	.00¼	.00½
Great Northern	.02½	.03
Hargraves	.00⅞	.01⅛
Hudson Bay	...	.25
Kerr Lake	4.40	4.65
La Rose	.60	.69
McKinley	.45	.51
Nipissing	5.50	5.65
Peterson Lake	.22	.22½
Right of Way	...	.04
Leaf	.02	.02½
Cochrane	...	.12
Silver Queen	...	.02½
Temiskaming	.17⅛	.18
Trethewey	.10	.14
Wettlaufer	.05	.05½
Seneca Superior	1.25	1.35

TORONTO MARKETS.

Mar. 9—(Quotations from Canada Metal Co., Toronto.)
Spelter, 15 cents per lb.
Lead, 5½ cents per lb.
Tin, 60 cents per lb.
Antimony, 25 cents per lb.
Copper, casting, 17 cents per lb.
Electrolytic, 17 cents per lb.
Ingot brass, yellow, 10c. per lb; red, 12 cents per lb.

Mar. 9—(Quotations from Elias Rogers Co., Toronto.)
Coal, anthracite, $8.00 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Mar. 8—Connellsville coke, (f.o.b. ovens.)
Furnace coke, prompt, $1.55 per ton.
Foundry coke, prompt, $2.00 to $2.50 per ton.

Mar. 8—Tin, straits, 50.00 cents.
Copper, Prime Lake, 14.75 cents.
Electrolytic Copper, 14.60 cents.
Copper wire, 15.87½ cents.
Lead, 3.95 cents.
Spelter, 11.25 cents.
Sheet zinc, (f.o.b. smelter), 13.50 cents.
Antimony, Cookson's, 27.00 cents.
Aluminum, 19.00 to 19.25 cents.
Nickel, 42.00 to 45.00 cents.
Platinum, soft, $41.00 per ounce.
Platinum, hard, 10 p.c., $44.00 per ounce.
Bismuth, $2.75 to $3.00 per lb.
Quicksilver, $60.00 per 75-lb. flask.

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22	....	22⅞
23	48¾	22$\frac{15}{16}$
24	48½	22⅞
25	48⅝	22⅞
26	48⅞	23
27	48⅞	23$\frac{1}{16}$
March—		
1	49¼	23¼
2	49	23¼
3	49½	23⅜
4	49⅛	23⅛
5	49¼	23$\frac{3}{16}$
6	49⅜	23¼
8	50⅛	23⅝

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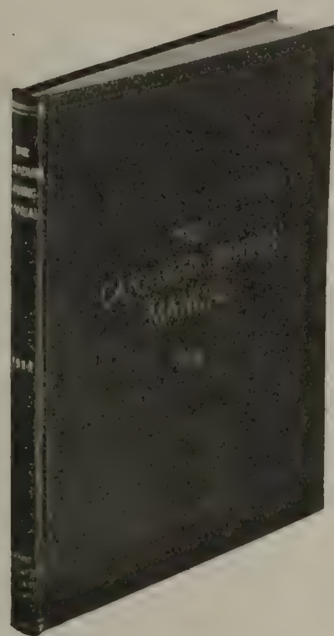

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Northern Electric Co., Ltd.
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Mussens, Ltd.
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Cranes—Overhead Traveling—
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Mussens, Ltd.
Boving & Co. of Canada, Ltd.

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Fraser & Chalmers of Canada, Limited.

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Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

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Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
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Northern Canada Supply Co.

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Northern Canada Supply Co.
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Mussens, Ltd.

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Northern Canada Supply Co.

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Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

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Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
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Dodge Mfg. Co., Ltd.

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Mussens, Ltd.
Alex. Fleck.
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Dodge Mfg. Co., Ltd.

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Dodge Mfg. Co., Ltd.

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Dodge Mfg. Co., Ltd.

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Smart-Turner Machine Co.
Peacock Bros.
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Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

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Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
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Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
Orford Copper Co.

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Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
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Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
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Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

Producer—Gas—
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
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Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
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Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
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Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
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Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

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Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville

Rope Blocks—
Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

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B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

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Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

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Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

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Hendrick Mfg. Co.

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Peacock Bros.
Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

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Thos. & Wm. Smith.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

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C. L. Berger.

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Northern Electric Co., Ltd.

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Dodge Mfg. Co., Ltd.

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Peacock Bros.
Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co., Ltd.

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Northern Electric Co., Ltd.
Peacock Bros.

Transits—
C. L. Berger & Sons.
Peacock Bros.

Transmission Rope—
Dodge Mfg. Co., Ltd.

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Dodge Mfg. Co., Ltd.

Tube Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

Winding Engines—
Mussens, Ltd.
Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.

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Northern Canada Supply Co.
B. Greening Wire Co., Ltd.

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Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.


10 FEET

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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 7

The Canadian Mining Journal, 2nd Floor, 44-46 Lombard St., Toronto, Ont.

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

THE CANADIAN MINING JOURNAL

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CONTENTS.

THE WORKING OF SMALL ORE DEPOSITS

In view of the number of gold deposits discovered in Northern Ontario during the past decade it is surprising that there are so few deposits being worked. Ontario, chiefly owing to the Hollinger, Dome, Acme, McIntyre and Porcupine Crown mining companies, has become a large producer of gold; but the number of mines producing is small.

There was produced in Ontario during 1914, according to the preliminary report of the Deputy Minister of Mines, Mr. T. W. Gibson, 268,942 ounces of gold, having a value of $5,529,767. Eight mines at Porcupine, and four in other parts of the Province contributed to the total. The producers were Hollinger, Dome, Porcupine Crown, McIntyre, Acme, Rea, Porcupine Pet. Porcupine Vipond, Canadian Exploration Co., Tough-Oakes, La Mine D'Or Huronia and Cordova.

The showing made by these twelve mines is a very good one and it is expected that during the present year production will be increased. It is quite certain that some of these mines will be large producers for years and that large profits will be made from their operation. Gold mining has become one of Northern Ontario's many successful industries.

But while these few companies are operating so successfully there is not the interest in the development of prospects that such results warrant. Many gold quartz veins have been found; but few of them worked. The prospects that have not fallen into the hands of companies with large resources are idle. The prospector has been told that it takes millions to make a gold mine. He has seen cases where failure has resulted from lack of capital, and he has lost hope of developing his claims himself or of having them developed by companies that are organized on a modest scale and in which he might expect to retain a considerable interest. Being without funds and unable to interest small investors, he is forced to forego his desire to work his property.

This condition of affairs is not unusual; but it need not necessarily be accepted as inevitable. Lack of public interest in mining ventures can be attributed to many causes; but the prospector is not often to blame. We know that many investors have failed to take up claims because of unreasonable terms demanded by prospectors. The real trouble in many cases, however, is that the prospector is not dealing with men who want small mines, but with men who want to develop large deposits and who want complete control. In the case of large mines control must naturally be in strong hands. But the working of small deposits in a small way, should be encouraged.

In this issue Mr. Geo. R. Rogers points out how the owners of small gold deposits in Australia were enabled to work their properties. The State Batteries unquestionably stimulated mining there and might do the same here. Increased production is demanded these days of Canada and the Empire. We will be pleased to have our readers state how in their opinion the development of properties might be encouraged.

NOVA SCOTIA METAL MINING IN 1914

The report of the Inspector of Mines of Nova Scotia for the year ending Sept. 30th, 1914, in addition to the usual statistical information, contains interesting notes by Mr. W. H. Prest on the metalliferous mines of the Province.

There was milled during the year 13,156 tons of gold ore, yielding 3,158 oz. gold. Of this Guysboro county produced 1,604 oz., Halifax, 1,245 oz., Queens, 44 oz., and Victoria 262 oz. The operators of producing mines were Donaldson Reeve, John and Alex. Greenough, Loon Brook Mining Company, Petpeswick Mining Company, Caribou Gold Mines, Ltd., George Cameron, Dominion Mining Company, Goldenville Mining Company, Stormont Mining Company, D. McAskill, Switzer Mining Company, Stillwater Mining Company, and Bras D'Or Mining Company. In addition to these operators several others did prospecting and development work during the year.

The antimony mine at West Gore was pumped out. The tin and tungsten deposits at New Ross were neglected. The manganese mines were idle.

The Nova Scotia Mines Department revenue for the year was $760,561.39, of which the royalty on coal amounted to $704,188.94. A review of the Coal Trade of Nova Scotia, by Mr. F. W. Gray, was published in our Jan. 15 issue.

NON-METALLIC MINERALS USED BY MANUFACTURERS

A very interesting account of the utilization of non-metallic minerals in manufacturing industries, written by Mr. Howells Frechette, has just been published by the Mines Branch, Ottawa. Mr. Frechette was commissioned by the Mines Branch to visit manufacturers throughout the Dominion, with instructions to obtain from them as much information as possible regarding the non-metallic minerals used by them. This work has resulted in the gathering of very valuable data. Mr. Frechette's report is an important contribution to our knowledge of the uses of the non-metallic minerals, and is full of suggestions for the guidance of those who are engaged in their production and utilization. Extracts from the report will be found on another page.

NOTES

Anaconda Copper Mining Co. will spend $6,000,000 in plant improvements and betterments at Anaconda, Great Falls and Raritan. Anaconda is making great changes in methods of treating copper ores.

The Canadian Mining and Exploration Company reports that during 1914 a large number of investigations were made and that of the properties examined several had merit and would justify exploration. Favorable terms were not obtained, however, and no business was concluded that justified a call upon the shareholders for subscriptions.

The appointment of Mr. J. R. DeLamar to succeed Mr. Ambrose Monell as president of Dome Mines, seems to be popular with the traders.

According to a despatch from Vancouver, fifty miners were killed and as many more injured on March 22, by a snowslide which swept away several houses at Britannia Beach, Howe Sound, B.C. Details of the disaster have not yet reached us. The sympathy of miners everywhere will be with the families of these unfortunate men.

The annual report of McKinley-Darragh-Savage Mines of Cobalt, Ltd., shows that during 1914, 1,660,076 oz. silver was produced. The new ore developed is expected to yield 582,896 oz. The decrease in reserves is therefore 1,077,180 oz.

Seneca-Superior reports for 1914 an increase in profits over 1913. Considerable new ore was opened up; but the ore between the third and fourth levels proved to be lower grade than expected.

The Temiskaming Mining Company's eighth annual report is an optimistic one. The results of development during the past few months have been very good.

MR. G. G. S. LINDSEY LEAVES FOR CHINA.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Monday, Mar. 22, to bid farewell to Mr. Lindsey, president of the Institute, who is now on his way to China. Mr. Lindsey returned from London on Friday, March 19th, and after a few days in Toronto started on his long trip to Pekin. He is accompanied by Mrs. Lindsey and their younger son. Mr. Charles Lindsey goes to the front with the second Canadian contingent.

The sentiments of members of the local branch were voiced by Chairman A. J. Young, Mr. T. W. Gibson, Dr. W. A. Parks, Professor H. E. T. Haultain, and Lieut. B. A. C. Craig. Mr. Lindsey in thanking the members for their good wishes scolded the Council for not accepting his resignation as president of the Institute. He threatens to insist on his resignation being accepted if his sojourn in China seems likely to prove a long one.

That Mr. Lindsey will be successful on his important mission is the wish and the confident feeling of the men who know him.

SHOULD ONTARIO HAVE GOVERNMENT BATTERIES?

By Geo. R. Rogers.

Of the various causes to which the decline in prospecting can be attributed perhaps the chief of those within human control is the lack of sufficient capital to develop the many promising properties already acquired and held by the prospector. Considering the vast area of mineral lands and the large number of claims staked and in good standing, it is natural to conclude that the stimulation of prospecting is not the problem that is most urgently in need of immediate solution. What is needed now is the introduction of some scheme that will tend to stimulate mining.

The average prospector in Northern Ontario if approached on the subject of prospecting will tell you that he has more mining claims than he is financially able to take care of. He will tell you that although his prospect has merit, he cannot induce capitalists to take over the property and develop it. It is generally understood that the large financial houses will not undertake to develop small deposits. Consequently, a large number of small prospects that would become producers if capital could be found to work them are lying idle.

The conditions existing in Ontario at present are similar to those which existed in the State of Victoria twenty-five years ago. There were then in Victoria many properties held by prospectors and miners containing small, but rich veins, which were not large enough to attract the attention of the average investor.

It was believed by many that if the Government could be induced to erect a small plant at some point within a reasonable distance of these properties for the purpose of treating small quantities of ore for miners and prospectors it would be the means of adding considerably to the annual production and incidentally would stimulate prospecting. The Government of Victoria has always played a prominent part in fostering the mining industry. It did not require much agitation on the part of those interested to induce the Government to give the scheme a trial, with the result that in 1897 the first State battery was erected. The close of 1913 saw twenty-six State Batteries in operation in Victoria.

Good Results From Operation of State Batteries.

For ten years previous to the introduction of the State Battery scheme, the gold production of Victoria was sadly on the decline.

During a period of eleven years following the inauguration of the scheme there was an appreciable increase in the production.

The following year, 1898, the State Battery system was inaugurated in Western Australia. The number of State Batteries in existence in this State at the close of the year 1913 was 40. **From the inception of the scheme to the end of 1913 gold and tin to the value of twenty-one million dollars was added to the world's production.**

During the year 1913 the gold ore treated by State batteries amounted to 60.573 tons, which gave a return of 52,515.55 fine oz. of gold.

The working expenditure for plants during the year totalled $276,808.35 and the revenue $239,953.18, which after including the cost of new additions paid from revenue shows a loss of $38,558.20, on the year's operations.

The capital expenditure from the inception of the scheme was $1,161,885.70. The cost of administration is about $17,000 per year. The average cost of ore treatment is $3.25 per ton.

The following table shows the number of tons crushed, average per ton recovered by amalgamation, and value since the inception to the end of 1913.

Gold Ore Treated by Western Australia State Batteries.

Battery	Tons treated.	Gold Yield Bullion Oz.	Average Gold per ton Oz.	Value
Bamboo Creek .	729.00	1,058.50	1.45	$19,050
Black Range...	54,110.65	58,356.38	1.07	1,051,390
Boogardie.	45,114.65	24,623.82	.54	450,195
Burtville.	28,399.00	61,874.26	2.17	1,120,265
Coolgardie.	55,896.75	47,670.47	.85	858,350
Darlot.	32,955.25	37,446.99	1.00	691,185
Laverton.	12,278.50	13,453.96	1.09	248,205
Leonora.	50,219.45	52,607.89	1.04	964,340
Linden.	12.644.25	13,237.29	1.04	238,270
Meekatharra. . . .	57,769.75	71,954.12	1.24	1.308,570
Menzies.	54.574.25	44,199.67	.81	794,830
Marble Bar	6,076.00	7,284.15	1.19	131.110
Mt. Egerton ...	2,616.00	1,718.20	.66	27.260
Mt. Ida	35,674.90	49,896.16	1.40	914,640
Mt. Jackson ...	3,376.75	6,062.49	1.79	109,120
Mt. Keith	2,058.25	1,790.60	.87	32,230
Mt. Sir Samuel.	6,839.25	5,298.40	.77	95.370
Mulline.	72,424.70	94,240.85	1.26	1.692,235
Mulwarrie.	29,116.40	33,842.36	1.16	625.445
Nannine.	10,116.35	5,971.84	.59	107,490
Niagara.	57,278.00	50,077.37	.87	912,330
Norseman.	52,089.20	54,817.92	1.05	1.002.635
Ora Banda	2,841.00	1,126.72	.39	20,280
Payne's Find ..	5,252.50	6,199.55	1.18	111,590
Pig Well	16.666.50	16,712.53	1.00	300,830
Pinjin.	16.820.15	12,743.68	.75	229,385
Quinn's.	6,713.00	3,736.15	.55	67.250
20-Mile Sandy. .	9,187.90	16,310.02	1.77	294,080
Siberia.	12,664.00	13,885.69	1.09	249.570
Wiluna.	43,739.25	26,722.65	.61	481,730
Yarri.	39,133.00	26.066.11	.66	469.190
Yerilla.	11,318.50	10,882.40	.96	181.870
Youanme.	18,897.00	7,464.69	.39	134.365
Lennonville. . . .	30,496.39	34.578.09	1.13	647.690
Tuckanarra. . . .	15,456.85	20,897.56	1.35	384,275
Widgiemooltha .	5,711.00	2,413.43	.42	44.745
Ravelstone.	11,993.80	11.482.32	.95	212.535
Batteries closed.	31,740.80	22,859.76	.72	421,195
	960,989.44	971,565.24	1.01	17,644,095

The following table shows the number of **tons of tailings treated** since the inception to the end of 1913:

Battery.	Tons. treated.	Yield fine ozs.	Value.
Black Range	31,102	8,528.89	$179.715
Burtville.	15,558¾	5,143.94	107,145
Coolgardie.	27,144	4,647.69	97,285
Laverton.	9,350	1,091.14	22,195
Leonora.	32,368½	7,993.12	165,905
Linden	10,057	3,055.42	64,900

Meekatharra	34,190	7,019.82	146,000
Menzies	30,587½	7,891.04	165,375
Mulline	41,456	11,560.61	234.435
Mulwarrie	22,871½	4,391.24	990,065
Niagara	36,917	5,940.96	123.285
Norseman	36,206½	7,419.67	153.795
Pinjin	11,718	1,243.07	26,280
Sandy Creek	8,141¼	2,584.61	54,320
Siberia	5,550	1,201.56	25,525
Wiluna	14,349	6,156.62	130.270
Yarri	30,880	2,801.09	58,175
Yerilla	8,800	1,106.56	23,505
Youanmi	7,799	2,382.25	50.595
Mt. Sir Samuel	2,966	625.24	13.280
Payne's Find	2,805	350.92	7,500
Darlot	23,654	2,699.17	55.210
Lennonville	24,309	6,592.43	133.065
Mt. Ida	3,570	357,97	7,120
Nannine	3,650	410.12	8,710
Boogardie	29,432	7,702.28	160.930
Duketon	2,083½	250.51	5,130
Devon	261½	120.44	2,555
Southern Cross	3,471	452.75	9,075
Yundamindera	4,977	920.33	19,545
Randalls	791	56.05	1.125
Pig Well	11,379	2,373.25	49,810
	528,395	115.069.76	2,391,875

The following shows the number of **tons of slime treated** since inception to the end of 1913:

Battery.	Tons treated.	Yield fine ozs.	Value.
Mulline	21,348¾	6,833.05	$122,785
Black Range	13,040	2,604.59	55,320
Burtville	1,643	519.00	11,020
Menzies	21,905½	5,454.53	115,860
Meekatharra	1,980	462.78	9,830
Niagara	13,875	2,175.45	46.210
Sandy Creek	293½	75.00	1,590
Darlot	570	82.61	1,120
Linden	419	87.30	1.855
Leonora	12,440	2,198.09	46,695
Norseman	11,671	2,843.10	60.380
Laverton	273	45.24	960
Pig Well	340	64.65	1,370
Boogardie	1,218	284.63	6,045
Yerilla	424	44.55	954
Yarri	3,162	287.02	6,095
Wiluna	2,597	913.21	19,395
Siberia	345	104.47	2.220
	107.546¾	25,049.27	509.699

In addition to the above there was 64,919¾ tons of tin ore treated which produced tin to the value of $404,175.20.

My object in writing this article is for the purpose of inviting discussion. If the conditions in our Ontario gold fields warrant the introduction of the scheme and it could be operated to advantage, it should at least get a trial. I am of the opinion that it would stimulate mining, and it will be admitted that any scheme which will stimulate mining will incidentally stimulate prospecting.

CANADIAN MINING INSTITUTE—WESTERN BRANCH

The nineteenth general meeting of the Western Branch of The Canadian Mining Institute was held in Victoria, British Columbia, on March 11. Three sessions were held; in the absence of Mr. S. S. Fowler, chairman of the branch, who was in Ontario at the time, different members were called to preside over each session, Mr. W. M. Brewer having been in the chair at the morning session, Mr. Wm. Fleet Robertson at the afternoon session, and Mr. Thomas Graham at the evening session.

At the morning session Sir Richard McBride, Premier and Minister of Mines for British Columbia, delivered an address in which, after briefly commenting on the creditable showing the province made in its mineral production in 1914 notwithstanding the unfavorable conditions brought about by the outbreak of war in Europe, he referred to the preparation that had been made for increasing the production of coal at Vancouver Island coal mines, directed attention to the considerable advance in copper production in the Coast district of British Columbia with an output in 1914 of more than 24,000,000 lb. of copper as compared with 15,500,000 lb. in 1912, which was the highest previous yearly total, and then dwelt at some length on the important effect of railway construction on the mining industry of the province, giving as a striking example figures showing that a total of $460,000,000, which was the value of the mineral production of British Columbia for all years to the end of 1913, $253,000,000 or 55 per cent. was produced during the last ten years, that is to say the total production for the ten-year period 1904-1913, with adequate railway transportation facilities in the larger mining centres, was of greater value than for the fifty-two previous years, included in the official records. With that experience before them, it was quite reasonable to look for a further large increase in the mineral production of the province as a result of additional railway construction recently completed or approaching completion.

A brief review of mining in the province in 1914, together with an estimate of the value of the mineral production in that year, was submitted by Mr. W. F. Robertson, provincial mineralogist.

A paper by Mr. Thomas Graham, Chief Inspector of Mines, giving statistics of mine fatalities in the province in 1914, and a statement showing their causes, with some striking comment on the figures submitted and suggestions for bringing about improvement in avoiding preventable causes of accident and in the promotion of the "Safety First" movement, completed the morning programme.

The afternoon session was chiefly occupied with a discussion initiated by Mr. W. M. Brewer, who read a paper entitled "The Prospector and Prospecting," and who emphasized his view that co-operation between the prospector and the community living in the neighborhood where he is prospecting is one of the chief conditions essential to progress and success of the prospector in the mining industry of any country, and since there is to-day practically no such co-operation, the old-time prospector has disappeared.

Mr. Dudley Michel, instructor in First Aid to the Injured, on the staff of the Provincial Department of Mines, gave information concerning the work he was engaged in during seven months of 1914 in connection with giving first aid instruction to metalliferous min-

ers, and indicated the proposed policy of continuing the "Safety First" movement among the miners.

Mr. W. J. Elmendorf contributed some notes on the work done by the Portland Canal Tunnels, Ltd., in driving a long crosscut adit near Stewart, Portland Canal mining division.

At the evening session the programme was as follows: Notes on the Puntledge River Hydro-Electric Power Development in Comox district, Vancouver Island, of the Canadian Collieries (Dunsmuir), Limited, with lantern slide views, by Mr. E. Jacobs; paper on The Value of Efficiency Records in Colliery Management, by Mr. J. H. Cunningham, of Ladysmith, Vancouver island, manager of the Wellington mines, Extension; Notes on a New Method of Burning Coals, by Mr. H. N. Freeman, of Nanaimo, manager for the Vancouver-Nanaimo Coal Mining Co.; Notes on Reinforced Concrete Tipple and Head Frame at Morden, Vancouver island, by J. H. Tonkin, of Victoria, president of the Pacific Coast Coal Mines, Ltd., illustrated by lantern-slide views; notes and slides showing the tipple, Marcus screens, and power plant at the No. 8 mine of the Canadian Collieries (Dunsmuir), Ltd., in Comox district, Vancouver island; views of the Provincial Government Mine-Rescue Station at Nanaimo, and the Rescue Car of the Western Fuel Company at the same place; and a paper by Mr. George O'Brien, instructor at the Provincial Government Mine-Rescue Station at Fernie, Crowsnest district, B.C., entitled "Instruction, Organization, and Care of Rescue Parties Using Self-contained Breathing Apparatus in Mines After an Explosion and When Fighting Mine Fires."

In addition there was a short business session at which some branch matters were considered and disposed of. The several sessions were fairly well attended and interest in the proceedings was maintained throughout the meeting.

THE PANAMA CANAL.

Volume I. of the Transactions of the International Engineering Congress, 1915, will comprise a unique series of papers on the engineering of the Panama canal. The various topics and subdivisions of the work have been arranged by Colonel G. W. Goethals, Chief Engineer of the Canal, and now Governor of the Canal Zone. Colonel Goethals has also selected the author for the treatment of each paper, and he will himself contribute the introductory chapter. The various authors are in general the officers who were in direct charge of the actual work of construction, and the collection of papers thus becomes a first-hand account of the engineering of the Panama canal, written by the men who were in immediate and responsible charge of the undertaking.

There will be twenty-four papers in all, profusely illustrated, twenty-two of which deal with actual constructive and engineering problems connected with the work, one with the preliminary work in municipal engineering in the Canal Zone, and one with the commercial and trade aspects of the Canal.

This volume would in itself be a valuable acquisition for any person interested in the progress of the world's work, whether or not an engineer, and for any library, whether technical or not. It can be obtained only through enrollment in the Congress.

The transactions of the Congress as a whole will include from seven to nine other volumes, covering all important phases of engineering work.

Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work.

GRANBY.

It is understood that January earnings of Granby Consolidated based on 14½ cent copper were close to $100,000.

January operations of the Grand Forks and Anyox smelters resulted in a production of 2,170,139 lbs. of copper against 1,616,556 lbs. in December and 2,706,595 lbs. in June, which is the highest yield from the two plants to date.

Detailed yield of the two smelters in January was as follows:

	Grand Forks.	Anyox.	Total.
Copper, lb. ..	775,786	1,394,353	2,170,139
Silver, oz. ...	12,223	19,053	31,276
Gold, oz.	2,019	506	2,525

By the middle of the current year Granby should have reached the maximum tonnage thus far planned for. This would entail full operations at the Grand Forks plant, three furnaces in blast at the Hidden Creek property and the inauguration of shipments from the Midas mine in Alaska, work upon which has been suspended for several months.

Dividends will probably not be considered before the April meeting of directors. The last disbursement was made in June, 1914, the amount being $1.50 per share.—Boston News Bureau.

The following is an excerpt from an article published in the Weekly Report of the Department of Trade and Commerce, Canada, on "Russian Trade Possibilities." Russia, commercially and industrially, is a vast reservoir as yet scarcely tapped, with an area of 8,647,-657 square miles, and her population of more than 170,000,000 fast awakening to a new phase of civilization. Russia's wants are many and urgent, and she has to offer in exchange much for which the markets of the world crave. Her possibilities cannot be grasped at once, even by her own people. At present Russia is essentially an agricultural country, with vast tracts under exploitation, other regions mapped out ready for settlers, and yet more land practically unexplored. Siberia, until recently a closed region, is being opened as a fertile agricultural and pastoral country, where mining and other industries may also be organized. . . . In exchange for her metal ores we send her machinery, tools and manufactured metal goods. As regards raw materials, the chief timbers for export are pines, firs and oaks, with larch and cedar from Asia. Her minerals include gold, silver, copper, lead, mercury, asbestos, mica, coal and petroleum. Of platinum more than 90 per cent. of the world's consumption comes from the Urals. Mining still needs development, and is open to foreign capital, though there are certain reservations as regards the Amur and lands on the sea borders.

The many friends of Mr. and Mrs. J. B. Tyrrell will regret to learn of the death of Mrs. Tyrrell's mother, widow of the late Dr. G. M. Carey. Mrs. Carey died on Saturday, March 20th, in Ottawa.

THE INDUSTRIAL SERVICE MOVEMENT*

By J. Parke Channing.

These days of great industrial and social problems in America produce many suggested solutions and great changes. The practical engineer and employer of labor views these problems differently from the labor leader or the social reformer, but as never before he is sincerely interested in solving them in a way that will be just to all.

The inevitable tendency of the day is toward "industrial betterment," "safety," "industrial education," "efficiency," and the many other things which have become so familiar to progressive employers. There is no longer any question that these things are worth while from both the human and economic standpoints. They "pay" in dollars and cents.

The very center of final success in improving conditions and increasing the efficiency of workingmen must be the spirit of fairness and a knowledge on the part of the employer of how to deal sympathetically and intelligently with his employees. Every progressive employer knows how greatly he desires foremen, superintendents, managers and others who possess these qualities. On the other hand, we are all familiar with serious mistakes made by young graduates of engineering schools who have had no opportunity to develop these qualities, and who have no real appreciation of the worth of the workers. Indeed, one wonders whether much ill-feeling, labor difficulties, and many strikes could not be avoided if such men had the right attitude.

Is there any way of remedying this condition? If this particular difficulty can be solved, if these young engineers, many of whom are our coming leaders of industry, can be given the right perspective and the right understanding of these other problems in addition to fair, sympathetic methods of handling men, many of our other problems will be solved—not at once, but gradually and permanently, as these men make good and become influential in paths of industrial righteousness and industrial peace. Many progressive employers of to-day have enlarged their own perspective and realize the great importance of enlarging the perspective of those who shall follow them.

How can it be done? For seven years a movement has been making rapid progress in engineering schools with the purpose of helping to solve this very problem. It was started at Yale in 1907, by the Young Men's Christian Association, when some engineering students were led to get in touch with workingmen and boys in New Haven. The idea was to render service by teaching them English and other subjects and in turn to learn their ways, ideas, customs, and how to deal with them intelligently. Friendly, mutually helpful personal contact was the basic principle. This was the beginning. Do not confuse it with "social service"—it was this, and much more. The reaction on the engineer was the main object sought. The idea worked out so successfully that a number of men saw great possibilities in it, and the whole conception was greatly enlarged. Under the name of the Industrial Service Movement, it has spread to 200 other colleges and technical schools in the past seven years, and has justified itself from every point of view. It is really helping in a vital way to solve the special problem we have been discussing and other problems as well. It is to put it briefly:

Plan—Bringing engineering students and industrial workers together to their mutual understanding and their mutual good.

Purpose—To get workingmen educated and educated men to work. To send men out of college with a new sympathy, a new vision and a new determination to help.

Principle—Fraternity—not to go down to help others or to ask others to come up and be helped, but rather to go with them, not in any sentimental way, but in a spirit of common-sense brotherhood.

Method—Putting college students up against real opportunities for the kind of service which appeals to them, such as teaching foreigners English and citizenship; instructing American workingmen in technical subjects; leading clubs of working boys, etc. There is opportunity for every leader's peculiar ability to assert itself, in any way that is real. Other methods will be described later.

Accomplishment—During the past year 3,500 students from 200 colleges have engaged regularly in industrial service; 3,000 graduates are active in industrial betterment as a result of interest acquired while at college during the past seven years.

Leadership—The Young Men's Christian Association, through local branches, State committees and the industrial and student departments of the International Committee.

Co-operation—The movement works locally through the Young Men's Christian Associations and any other recognized agencies for industrial and social betterment in the community. Professors and students, employers and employees, engineers and social workers heartily co-operate.

Significance—Experience proves that men interested in this work at college go out into the larger world with a new vision and a new attitude and sense of responsibility. These men will largely determine whether conditions shall be good or bad and whether the human factor will be given fair consideration. How better can the problems of capital and labor be solved than by mutuality, good will, efficiency and character in business. The nation's hope is in the coming leaders who shall follow us and who possess such essential qualities of success. The development of such leaders, with their continually increasing capacity for service, is the ultimate purpose of the Industrial Service Movement.

It may seem surprising that 3,500 engineering students, each carrying a heavy course of study and with many other interests, can find an evening or two each week to engage in some form of definite service, without any financial compensation. But such is the case, and on the whole a careful survey of their work reveals efficiency and permanency in a high degree. If industrial men are at first suspicious, their suspicion soon wears away in the face of frankness and friendliness. If the employer has any doubts, they do not last long. One may travel around the country and observe students teaching foreigners in railroad box cars, stores, clubs, halls, pool rooms, restaurants, and boarding houses as well as in the more dignified meeting places—schools, churches, settlement houses, and factories. One may see American workingmen instructed in mines, shops, and labor union headquarters. One may look with interest upon recreative games, talks, first-aid and safety promotion in all sorts of places at noon, afternoon, evening, and midnight. And one may see 500 men crowded around the machinery of a huge plant listening to a straight noon-hour talk on clean living, character-build-

*Extract from a paper read at the New York Meeting American Institute of Mining Engineers, February, 1915.

ing, and vital religion. We have looked with amazement on 50 factory boys following enthusiastically a college football captain who took enough interest in them to organize a boys' club or a factory athletic league. It has all been done in the finest kind of spirit, without patronage, with modesty and with efficiency. And during the past year those 3,500 student leaders reached over 60,000 workingmen and boys in a very personal and directly helpful way. The secretary of this movement has talked with hundreds of employers and college professors throughout the country and all seem enthusiastic over what has been accomplished.

But what has this to do with engineering? Just this—that every one of these 3,500 students would be willing to say that he has gained far more than he has given. Furthermore, a study of the situation proves that he has gained in large measure the very qualities he needs—an appreciation of workingmen, adaptability, leadership, a knowledge of how to deal with men in a way to get results and to avoid harmful labor difficulties. In general, he learns that all men are men, regardless of race, nationality, color, or creed, but that men must be dealt with very differently; he learns that it pays to win the leaders of men if one desires to win the men themselves; that the work, home and leisure life of industrial workers play a large part in determining efficiency; that a man's working associates may largely influence the quality of work he does; that helping men to concentrate on their work (though not at the expense of mental and physical welfare) increases output; that friendly competition (without driving men) helps break records; that reasonable relaxation and recreation pays both from the human and economic standpoints; that visitation of other plants and stimulation of new ideas in various ways may mean a money saving to the company; that loyalty of the men is one of the employer's greatest assets; and that character counts most of all. More than this, he learns to understand men, he learns how to sympathize with the other fellow's point of view and how to handle men successfully. Is this not worth while? Who can foresee what the future will hold for these men in the way of tremendous opportunities and responsibilities?

Let us illustrate. One engineering student apparently never took any interest in any one but himself until he was enlisted in some of this work. Two evenings each week he walked two miles to teach a class of twenty coal miners. The miners learned a great deal, but they little realized how much they were teaching the college man. His whole viewpoint was gradually changed. He learned to appreciate that all men were men, and he graduated from college with a new vision and a new sense of responsibility. He had not become a sentimental idealist. He perhaps realized the weaknesses of workingmen better than ever, but he had come to know their good points as well, and he had developed a real point of contact. It was therefore not surprising to receive a letter from him recently, indicating his growing interest and telling enthusiastically of his success with a welfare club house and other educational, recreative, and social features introduced for his miners.

It happens that I am a member of the Advisory Committee of the Industrial Service Movement, the headquarters of which is at the office of the Y. M. C. A. International Committee, 124 East 28th Street, New York. Several times I have seen letters from recent engineering graduates, which have come to the central office. These letters tell the story in no uncertain terms, and from them the following quotations are taken:

"I have organized several classes for men in our plant. I can say honestly that this friendly basis with my men helps rather than hurts discipline. The work is but a beginning of what my company hopes to do."

"You will no doubt remember that I took up this work last winter at the University. Now that I have gotten into the habit I really like it so much that I am devoting some of my time to it now, though I am very busy with my business. I have gathered together a class of about forty Italians and enjoy it immensely."

"My company is just now organizing a scheme whereby classes will be offered to young men in such subjects as relate to their work. I have consented to teach one of these groups, as this is the same sort of work I did when at college."

"I have read the literature with care and interest. I expect in the near future to be called to a position in New Mexico where I will come into close contact with foreign miners. My special work will be in the promotion of education and accident prevention."

"I consider the contact that I had with the Industrial Service Movement the most valuable experience in my undergraduate days. I would never be where I am today, without it."

THE KING OF THE BELGIANS

Albert is down by the Yser, the Kaiser's enthroned in his place;
Albert's no home but the trenches, along with a few of his race.
Teutons have ravished his country, the Vandals have sacked his Louvain;
Belgians are starving and homeless, forlorn in the cold and the rain.

Albert, a man of the Belgians, a Caesar defied for the right,
Crushed by the might of a braggart who loudly proclaims him in flight.
Lands he no longer possesses, his army is shattered or fled;
Albert's no longer a kingdom, the Kaiser's enthroned in his stead.

Albert's no longer a kingdom? But what say the men of Moose Jaw,
Glasgow and London and Belfast, of Sydney, Punjab and Mysore?
Ask where the tricolor's waving, ask of the legions of France,
Question the Sengalese trooper or swarthy Algerian lance.

Talk with the Moujiks of Moscow, their comrades, the Cossacks of Don;
Ask the Siberian Rifles from Baikal and Tomsk pressing on.
What do the peoples all answer from Cape Town to Nippon afar,
Men of the hardy Black Mountain or Sanjak of Novibazar?

Albert's the world for his kingdom, he's first in the hearts of them all.
Ally or neutral they reck not, the world is alive to his call.
Belgium's distress must be succored, her citizens nourished and then—
Lackland may call on a Kaiser along with ten million armed men.

—Boston News Bureau.

NOTES ON OMINECA MINING DIVISION, BRITISH COLUMBIA

The following notes will serve to give a general idea of the progress made during 1914 in mining in Omineca mining division, the office of the Gold Commissioner for which part of British Columbia is at Hazelton, Skeena river:

Lode Mining—Shipments of ore were made from the undermentioned properties: From the Silver Standard, on Glen mountain, 736 tons; the Victory group, on Hudson Bay mountain, 25 tons; the Harris mines, on Nine-mile mountain, 25 tons; the Colorado group, Hunter's basin, 25 tons. The ore from the Colorado group was packed out to the Grand Trunk Pacific railway in the summer, but had not been shipped to the smeltery by the close of the year.

Mining properties situated on Nine-mile mountain that were worked continuously throughout last summer, but work on which had been suspended later in the year, were the American Boy, Silver Bell, Silver Cup, and Silver Pick.

Work was continued on the Silver Standard until about the end of August, when operations were stopped for the time being. There is on this property much ore ready for shipment. The Black Prince group, also on Glen mountain, was worked steadily, under lease, all last summer, and it is stated that a lot of ore was sacked ready for shipment. The Harris Mines, Ltd., continued the development of its mine, the American Boy, until the outbreak of the European war, when it was closed, but it is intended to shortly resume shipment of ore.

On Rocher Deboule mountain there was mining activity on several properties. The Black Prince and Wonder groups were developed under bond until the war trouble came on and then work was stopped. The Great Ohio group, which last year was acquired by Portland, Oregon, interests, has been developed and it is stated some good bodies of ore have been found. The operations of the Rocher Deboule Copper Co. have been the most extensive of all in this part of the district. A 200-h.p. hydro-electric power development on Juniper creek has been completed. A transmission line has been constructed four and one-half miles from the power station to the mine where there has been installed an electrically operated compressor with a capacity of 744 cu. ft. of air per min. at 90 lb. pressure. A Leyner drill-sharpener is included in the power equipment, also an 8x10 double-cylinder single-drum geared hoist, used for hoisting men and material from the camp to the mine over an incline tramway 1,800 ft. in length at about 30 to 34 deg. An aerial tramway has been constructed to convey ore down to the main line of the Grand Trunk Pacific railway. Much underground development work has been done in the mine, with generally satisfactory results. Following the declaration of war in Europe, however, operations were stopped until such time as conditions shall be favorable to again operating the property.

Coal—Coal measures in the Bulkley valley in the neighborhood of Chicken (Kathlyn) lake, have been prospected and samples of the coal have been sent out.

Placer mining—Mr. G. W. Otterson, general manager for the Kildare Mines, Ltd., of Ottawa, which company holds several placer leases on Slate creek, a part of the district much more distant from Hazelton than the silver-lead and copper camps above mentioned, at the end of last season supplied the district Gold Commissioner with a most favorable report relative to the prospects of his company's properties. He stated that: "The paystreak found appears to be exceedingly rich, and the portion passed through the sluice-boxes gave a yield of about $30 to the cubic yard. The outlook for next season is excellent. Having discovered the paystreak and uncovered it for more than 100 ft., there is now something definite to go upon. . . The gold recovered is all coarse, with pieces varying in weight from a few grains to seven-eights of an ounce. One nugget weighing an ounce and three-quarters was picked up and was forwarded to Ottawa."

ADVANCES IN OIL REFINING.

U. S. Secretary of Interior Lane announces two chemical processes, developed after years of research by Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines, one of which is expected to enable oil refiners to increase their output of gasoline by 200 per cent.; the other makes possible production from crude petroleum of toluol and benzol, bases for dyes and high explosives, for which in past United States and the rest of the world have depended almost exclusively upon Germany.

Commenting on this announcement the Boston News Bureau says: The head of one of the biggest Standard Oil refineries when questioned regarding the discoveries of Dr. Walter F. Rittman, which government officials have stated will treble the output of gasoline and will make it possible to obtain toluol and benzol from crude petroleum, said that the Standard Oil companies for years had known of ways in which they could greatly increase their output of gasoline and that the only reason these new processes had not been put into operation was that they were too expensive. In other words, the Standard Oil companies and other companies can make more money by producing a smaller quantity of gasoline from crude oil under present processes than they could by adopting the new methods and extracting an increased proportion of gasoline.

Up to date the "Burton" process, discovered by Dr. W. M. Burton, a director of the Standard Oil Co., of Indiana, has probably proved the most practicable of the new processes for refining gasoline. About two years ago the Indiana company began the manufacture of "motor spirits" under this process, but at that time it was used largely for tractors, etc., owing to its disagreeable odor. Since that time this objectionable feature has been overcome and "motor spirits" has taken the place of gasoline. Practically all plants of the Indiana company have been adapted to refine this product.

As for the manufacture of toluol and benzol from crude oil, the Standard Oil refinery head quoted above says the proportion of these products contained in crude petroleum is so infinitesimal that it is out of the question to manufacture them commercially. He says, furthermore, that if it were possible to compete with Germany, this country would produce all the toluol and benzol required from coal tar, of which a tremendous quantity is wasted each year. The only reason toluol and benzol have not been produced to any large extent in the United States, he says, is that such an industry cannot be built up without protection.

A TRIP TO GREAT SLAVE LAKE

By Gwynn G. Gibbins.

(Continued from last issue.)

Fort Resolution is about 800 miles north of Athabasca, and is situated on the south shore of Great Slave Lake a few miles west of the mouth of Great Slave river. The country here is low and marshy, and the view from Resolution is extremely dreary, nothing but flat country and marsh on the one hand and the apparently limitless lake on the other. It is about 500 ft. above sea level. Athabasca Landing has an altitude of approximately 1,700 ft., so we had fallen 1,200 ft. in less than 800 miles.

As seen from the lake, Fort Resolution is a very imposing place, with the Roman Catholic church, the Mission, R.N.W.M.P. barracks, Hudson Bay Company post, the Northern Trading Company posts, Fairweather's post and Swiggart's post, together with 50 or 60 Indian houses, some of which are cleanly and in repair.

St. Joseph's Mission has about 100 Indian boys and girls, who are quite well taught. Some are very intelligent, speaking, writing and reading English and French, and reading Latin exceedingly well.

The Indians have a curious way of paddling, whether singly or several in a canoe; they all paddle first a few strokes on one side and then again on the other side. They have the greatest respect for the lake, and seldom venture out in it, and never cut across any large bay, no matter how calm the water. They are excellent hunters and dog runners; but in the canoe they are hopeless. The Indian women do much of the hard work, though civilization has effected a notable change in their status. Many of them can do exquisite native fancy work in leather, porcupine quills, feathers and reeds.

Though the summer is very short and the winter severe, averaging about 20 degrees below zero for probably three months, it is remarkable with what success the efforts of those who have tried the fertility of the soil have been rewarded. The St. Joseph's Mission and the Hudson Bay Company have large gardens, in which are grown excellent potatoes, cabbages, turnips, onions, rhubarb, lettuce, radishes, peas, beans, etc. They have also experimented with wheat, rye, barley and oats with varying success. I understand that rye and barley will ripen, but that the other cereals are uncertain. The hardier flowers, such as sweet peas, nasturtiums, asters, pansies, sunflowers, daisies, sweet william, grow very well and flower profusely.

Boiler Rapids, Athabasca River, October, 1914

"**Treaty.**"—We were, fortunately, present during, or at least very shortly after, "Treaty" last July. This is a more or less formal yearly gathering of neighboring Indian chiefs and tribes, men, women, children and dogs, to declare their allegiance and to give white men the privilege of living in their country for the coming year. In return for this, the Dominion Government gives each individual Indian, irrespective of age or sex, the sum of five dollars, with a certain amount of tea, sugar, tobacco and flour. Tobacco and tea are prime necessities with the Indians—flour being of less importance. All the chiefs get twenty dollars, with corresponding larger portions of supplies. All complaints are heard and any misdemeanor in the past year punished and likewise any praiseworthy act rewarded.

"Pay-treaty" is held at several centres each year. At Fort Resolution probably $5,000 is distributed, the most distant Indians being the Dogribs and Caribou-eaters who come from Fond du Lac at the extreme eastern part of Great Slave Lake. After pay-day and the signing of the necessary documents, which is done

with great pomp, ceremony and importance by the various chiefs, supported by their "headsmen," a great rush is made to the several trading posts, and in a few hours the Indians have parted with the greater part of their treaty money. It was surprising to me to note the quality of the goods bought and how few really useless things were acquired. The

Dogribs at Our Camp on the Yellowstone River

men bought the very best pipes, blankets, socks, etc.—the younger men also generally got a silver ring for themselves and another for the maidens of their choice. The women bought cloth of excellent quality, many of the older women a pipe of inferior quality, and a shawl or ribbon of perhaps startling design. All are very fond of a scented soap, which they keep very zealously. They make their washing soap, that is, those who indulge in such luxuries, from lye and animal fat.

Marriage takes place at an early age and the Indian seems very devoted to his offspring. The women do not have baskets in which to carry their papoose, but put him or her in a shawl and sling it across the back, the youngster apparently instictively learning how to adapt itself.

At such times as "treaty," Christmas and Easter, old friends meet, and it is a quaint sight to watch the arrival of some Indians. The men kiss the women, some with evident relish, others with diffidence, and shake hands with the men, whether strangers or not. Everyone shakes hands in this far northern country. As soon after arrival as possible, the Chief pays his best respects to the R.N.W.M.P. and gives an account of the happenings in his tribe since his last visit—sometimes bringing a delinquent Indian for summary trial and punishment.

The festivities at "treaty" extend over a period of several days. In the daytime the men spend much of their time gambling for matches. A ring is formed and the men squat down, one or two beating a pom-pom and all chanting weirdly. One man then puts some matches in his hands under cover of a blanket and all try to guess which hand contains them. From the excitement and the gestures a stranger is apt to imagine the game is very complex, and the Indians themselves enjoy it for hours at a stretch. Occasionally a feast is held, followed by a dance. A tepee is prepared and huge pots of rice, moosemeat and tea boiled. An Indian then fires several rounds into the air. Soon the men begin to gather, each man bringing with him a saucer, cup and sometimes a fork or spoon. After all the men have arrived, the women, carrying their babies, and often with several other children hanging to their skirts, take any remaining places at the main "salon," while the rest gather around as closely as possible. The men are then fed and the remains given to their wives. The chief gives a speech, which is listened to with great respect and attention, the Indians now and then voicing their appreciation by a low guttural sound. The "feasters" then depart to return again in an hour or so, after the women have made things ship-shape again, for the dance, which usually begins about nine or ten o'clock. A few Indians, men and women, form a circle and shuffle sideways, all facing the centre, to the tune of some Indian chant repeated over and over again. Other men and women swell the circle and add to the swaying. From time to time some drop out for a spell, and so the dance goes on for perhaps six or eight hours. It is a very remarkable sight, and to me at least it was quite incomprehensible how any pleasure could be obtained from it. But the Indians often get worked up to a frenzy and the roar of the weird chant can be heard at a great distance.

It was a welcome sight to see how the Indians respected and aided the aged. We saw some of the late arrivals, the Dogribs—the least civilized of them all—get their treaty money. Among them was a very aged couple, and as the men got their five crisp one dollar bills, nearly all of them thrust one or more of the bills into the hands of the poor blind man as they were passing out.

From Fort Resolution we made several trips, the most interesting of which was up the north arm of the lake to the Yellowknife river, and thence up the Yellowknife for about 50 miles, making several portages. The river here is rather a succession of lakes connected by short narrow rapids and falls. This trip took us very close to the western fringe of the "barren lands," and evidence of its proximity was not lacking. We saw very little game, one bear and

St. Joseph's Mission, Fort Resolution, 1914

two wolverines being our total "bag." We left a little early for the caribou migration, but we saw plenty of horns.

Navigating Slave Lake.—On returning to Fort Resolution late in August, we experienced some of the winds so prevalent on Slave lake. For eight days we were stormbound on a small islet about 80 ft. wide

by 200 ft. long, on which, luckily, there was a plentiful supply of wood and cranberries. The wind gave us a hard tussle to make this haven, for we were just a little more than three hours paddling less than two miles. From this island we made Gros Cap in one long, hard day's paddle, bucking a fairly stiff breeze most of the time. Towards evening the wind freshened to a gale, and we were forced to seek shelter. Early the next morning we started to try to cross the fifty miles between the north and south shores of the lake. The swells from the night's gale were very large, so large in fact that we had no difficulty at all in weathering them. We simply apparently paddled up a steep hill and coasted down the other side. However, just as we were nearing the Caribou islands, about ten miles from Gros Cap, the wind started again, and in a very short time an ugly sea was running. We were lucky to reach the lee of these islands, because there is no other shelter between the Caribou islands and Gros cap.

The wind seemed to abate in an hour or so and we paddled along under as much shelter as possible to the outermost island. It had become much calmer and we decided to try to reach the next group of islands, about twelve miles distant, knowing that if we could make this group of islands our route for a further 15 miles or so would be behind an almost continuous chain of islands. It is essential at this time of the year to take advantage of every period of calm. Earlier in the summer the days were very long, in fact during June the sun appeared to sink a little west of north, and before the glow died away it started to rise again a little east of north. There was then no darkness at all, but now the nights were rapidly getting long, making it doubly hard to take advantage of the comparative calm usual early in the morning. With these things in view we set out, but we couldn't make it, and we had to run back to the island, getting drenched to the skin and our canoe about a third full of water.

Three days later we reached Fort Resolution and, finding the party with whom we had made arrangements to meet already there, we delayed as little as possible, and left on September 1st for the long arduous trip to Athabasca.

The Beast of Burden, Fort Resolution

Great Slave river, at this season of the year, does not lend itself readily for either tracking or poling, the banks and bottom being too soft, too steep, or too thickly wooded. In the spring, while we were en route north, the prevailing winds were northerly, but last September we did not get a fair breeze all the way from Resolution to Athabasca. The weather was disagreeable, wet, squally and foggy, always very chilly and raw. So it was a relief to reach Fort Smith and there to get dried out.

Baling Furs in H.B. Co. Press, Fort Resolution

News of the war.—We found the place all keyed to a high pitch, and on enquiry we heard that an Indian had just brought meagre news about a great European war. We lost no time in getting across the portage and were lucky enough to get a tug to tow us to Fort Chipewyan, which post we reached on September 16, and were staggered with the war news—the mail bringing papers as late as August 5th or 6th, having just arrived. Fortunately, our two remaining parties were awaiting us, so we bought a scow and left in tow of the tug for Fort McMurray.

The journey out.—If we were anxious before to get out, we were almost feverish now. Comparatively late news was obtained at McMurray, and the news was not too reassuring. We pushed on with all speed, but from here our progress was necessarily slow and laborious. We had to track our scow foot by foot all the way to Pelican. Owing to the wet weather there had been a number of mudslides, of which we reaped the benefit, having literally to wade through one to three feet of slime and mud. At times the current would be very strong and our footing in the mud very insecure, so that it was no unusual sight to see one or two of us turn turtle and disappear momentarily from sight, to reappear an unrecognizable mixture of mud and arms. There were nineteen of us all told. The two cooks stayed in the scow and also a steersman. The remaining 16 were divided into two parties, one working in the tumplines for 45 minutes, while the other party rested or had their meals. When necessary one or two of those resting poled on the scow to keep off rocks, etc. In this way we made continuous progress from daylight to darkness.

The rapids gave us plenty of excitement, which offset to a very considerable extent the hard work. We

often had to wade knee deep for an hour or more at a time in the icy, swift water. Some of the places were rather precarious, and it was no fun to get a ducking. As it was too risky to track through the rapids with the thin line, and as eight of us could not keep the heavy line out of the water, twelve and often fourteen men were on the line, while the others poled from the scow. Naturally such work was very hard on our footgear, and ere Grand Rapids were reached hardly anyone had sound feet or limbs, much less boots to wear. We had only two portages, Big Cascade and Grand Rapids. At the former we had a bad time getting our scow over—the water was very low. Everything removable was taken out of the scow, and by means of pries and the ropes we slowly dragged it to deep water. At Grand rapids we managed to get our scow to the island, and left it there, portaging our goods to the head of the island, without charge this time, since the "railway" had shut down for the winter, and loading them on another scow, which three of us had brought down from House river.

A rescue at Middle rapid.—Perhaps I will be pardoned if I describe a little incident that happened as we were tracking up into the Middle rapid. At the foot of the rapid we saw a scow, evidently heavily laden, with about a dozen men, women and children on board. The scow had struck a rock and had broken her back, but had held fast. We seemed to forget our weariness and soon had our lone canoe—we had sold all the others—out, and two of the boys managed to get alongside the scow. Firstly, the women and children were taken off, then the men. We learned that their scow had struck the rock through carelessness or drunkenness about 4 p.m. the previous day. One man had been drowned trying to get to shore and the others had spent a miserable anxious night on

Chipewyans Gambling after "Treaty," Fort Resolution, 1914

Dogribs Racing for Bread, Yellowknife River

the scow, fearing at each surge that the end had come. We fixed up a tent for them and gave them hot chocolate, etc., and then volunteered to try to save the cargo. This was a very ticklish job and the boys deserve great credit for their skill and daring. We unloaded our scow, and twice the boys got her alongside the wrecked scow and made her fast, took off a load and pulled for the bank. They drifted half a mile down stream each time, and we had to line them up. None of the rescued, save one, offered a hand whatsoever, tired though we were. Appearing helpless, we gave them our scow, beached theirs, repaired it, loaded it and went off—not getting so much as a "thank you" from them.

The track from Grand Rapids to House river was miserable. It was bitterly cold, windy and sleeting. Ordinarily the tracking here is very good, but on that day each mile seemed like ten. We all kept steadily on the line, because, wet through as we were, we could not otherwise keep from freezing, let alone keep warm.

We had hoped to get a gasoline launch at House river, but were disappointed in that the launch was already chartered. We plugged along to Pelican, but could go no further, so we accepted the hospitality of the Athabasca Oil Co. and made ourselves comfortable in their natural gas heated tents, awaiting the return of the launch. We arrived at Athabasca on the afternoon of October 10th.

I should like to add a line in appreciation of the splendid manner in which the R.N.W.M.P. perform their arduous duties and of their courtesy and kindness to us, particularly Inspector Field, Dr. Macdonald, Sergt. Mellor and Corp. Cuthbertson, and also the kindness extended us by the officials of the Northern Trading Co. and the Hudson Bay Co., Mr. Cunningham, of Fort Resolution, in particular, and Mr. Colin Fraser, an independent trader at Fort Chipewyan.

THE CANADIAN PAVILION AT THE PANAMA PACIFIC EXPOSITION

"Have you seen the Canadian Building?" "Believe me, the Canadians have some exhibit!" "Can you beat the Canadian Building?" "Canada has the whole blamed show beaten to a frazzle!" Such is the hue and cry that is being continually dinned into one's ears in the hotel rotundas, on the trolley cars, and in the streets of San Francisco, while the members of the Canadian commission and their assistants are each wearing a continual blush at the compliments hurled at them from all directions. And all this goes to show the wisdom of the government, who, notwithstanding the stress of war, has put up the finest exhibit that Canada has ever offered to the public, and, incidentally, has obtained the cheapest and most lasting advertisement for Canadian resources that could possibly be desired.

The mineral section of the exhibit probably offers the most complete display of Canadian economic minerals that has ever been shown outside of Canada, and is already attracting the attention of miners and prospectors, many of whom have declared their intention of seeing the minerals "in situ."

The ores are carefully labeled and tastefully arrayed in twenty-eight large, upright show cases and seventy small table cases, which occupy a prominent position in the central court of the big Canadian pavilion. In these cases practically every mineral, of economic importance, found in Canada has its place together with a card describing the locality in which it is found. The Mines Branch of the Department of Mines has issued a special bulletin, entitled Economic Minerals and Mining Industries of Canada for distribution at the Panama-Pacific International Exposition, which is in considerable demand, and a staff of three mineralogists is present to give detailed information on any particular mineral or locality.

In the big upright show cases large specimens are massed together, not only to give an idea of the general run of the ores, but, at the same time, to convey the notion of plenteousness of their occurrence in nature. Six cases are devoted to gold-silver-copper and gold-copper ores; these are mainly smelting ores from British Columbia that feed the three large smelters in that province. One case is given to the ores from mines operated by the Consolidated Mining and Smelting Co., of Canada, Ltd., and another to ores mined by the Granby Consolidated Mining and Smelting Co., of Canada, Ltd., and the British Columbia Copper Co. Besides ores, these cases contain products and by-products obtained from them. Asbestos and nickel ores, together with products made of, and obtained from, them respectively, each have a case, and make a very attractive showing. A large thirty foot case is given up to special specimens, such as gold nuggets from the Klondyke, nuggety gold ore from Nova Scotia and Porcupine, Ontario, very rich silver ores from Cobalt, and cut and polished semi-precious stones. The companion case to this is occupied by coals, cokes, coal briquettes, petroleum, petroleum shales, and tar sands. Typical Cobalt ores, some of which are cut and polished to better show the silver, have a case to themselves, and have, perhaps, attracted as much attention as anything in the exhibit. Two large cases, paneled with polished marble, are devoted to building and ornamental stones; and the rest of the cases are filled respectively with iron ores, chrome-iron and manganese ores; iron and steel made from Canadian ores or with Canadian coal; graphite, talc and apatite, mica, clay and cement and products made from the same, gypsum and feldspar, corundum, barite, celestite, stibnite, molybdenite, and pyrite; silver-lead ores, and zinc and silver-zinc ores. The seventy small table cases are occupied by typical specimens, and have been arranged to show, as much as possible, the geographical distribution of the ores.

QUINCY.

Quincy Mining Co. reports net profits of $205,593 from 1914 operations, against $76,160 in 1913, and $960,779 two years ago. Copper production totalled 15,356,380 pounds, secured from 22,612,460 pounds of mineral, which sold for $2,041,992. A profit of $12,630 was realized from silver sales, as compared with $20,383 in previous year.

President W. R. Todd says: "The price of copper began to improve early in November, when European nations entered the market with large orders for war material. On this buying we were able to sell copper that had accumulated, and resume dividends. We have undertaken no new construction, or renewals, that could prudently be deferred.

"Our sales of copper during 1914 were made at prices ranging from 15⅛ cents in January, to 11½ cents in November, advancing to 13½ cents at year end. The average was 13.3 cents. Our operations were seriously affected by strike, air blasts and the European war, and the company did not operate at a profit during the first six months of the year.

ELECTRICITY IN NOVA SCOTIA MINES

The report of the commission appointed by the Government of Nova Scotia to consider regulations governing the use of electricity in coal mines has been presented to the House of Assembly, and in a draft bill covering proposed amendments to the Coal Mines Regulation Act the Government asks for legislation to enable the commissioner to adopt whatever additional regulations may be considered necessary to give legal force to the recommendations of the commission.

In their report the commissioners pay a well-deserved tribute to the mining engineers of the Province, and state that, although no regulations governing the use of electricity in mines have as yet been enacted in Nova Scotia, "it speaks volumes for the regard shown by the operators for the safety of their employees and for the diligence with which the inspectors have exercised their office that safety first was the invariable rule, and that in every instance we found the greatest precautions had been taken to prevent accidents."

A reference to the great future of electricity in Nova Scotian coal mining, and the possibilities of this source of power in connection with the extraction of the vast submarine areas of coal around the shores of Cape Breton, is briefly made as follows:

"The great bulk of the coal to be won by the Dominion Coal Company and the Nova Scotia Steel and Coal Co. (and probably of other companies as well) lies below the sea. The mining of such coal must necessarily be at long distances from the source of power. Compressed air, which is now so extensively used, will be less effective owing to the loss of power in transmission, and there is no power known by which such work can be done so efficiently as electricity."

The commissioners might have gone further, and have said that in the present stage of human knowledge, there is no other form of power which can be used to extract coal at such distances from the source of power as it may be anticipated that future generations will see in the Cape Breton submarine coal field.

The commission is also numbered among the growing advocates of electric lamps for miners. One of the most interesting controversies among mining men of to-day is the respective merits and demerits of the flame safety lamp, and the electric lamp. The case for the electric lamp is well presented in the January volume of the Transactions of the Institution of Mining Engineers, by Mr. William Maurice. Mr. Maurice's paper is well worth the attention of all whom this subject interests. In this connection may be mentioned the vexed question of the causes of miners' nystagmus. Recent deliverances by medical men who have studied this matter have indicated that lack of light was the predisposing cause, and instances have been given tending to show that the ordinary miners' flame safety lamp was to blame because of the dimness of its illumination. A contributor to the discussion of Mr. Maurice's paper mentions that he had experience of two similar collieries, working side by side, one using candles and the other safety lamps, and there were more cases of nystagmus at the colliery using candles than at the safety lamp colliery. Again at another colliery employing 4,000 men, and using oil safety lamps there were no cases of nystagmus. The speaker very properly remarked that there must be some other cause than lack of light to account for the prevalence of nystagmus. Apart from the question of nystagmus, however, there is little doubt that electric lamps permit a much more effective illumination of the roof and sides than does the ordinary safety lamp. In this respect we may expect that electricity will force a similar improvement in oil safety lamps as was forced upon makers of steam driven machinery by the coming of electrical machinery. Competition is always a good thing.

The commission report that after having carefully examined the regulations adopted in many countries they decided to recommend practically the adoption of the British regulations governing the use of electricity in mines. The report states:

"In accordance with the statute under which we were appointed (Chap. 16, Acts of 1913) we have drafted regulations for the installation and use of electricity in mines, and beg to submit these as an appendix to this report (appx. B.). In drafting these we had the benefit of the experience of many other countries, as that experience had developed into rules and regulations. We examined closely the rules proposed as a standard set, after much such an investigation as we held, by the Bureau of Trade and Commerce, Washington. We had before us and very carefully considered the regulations adopted in England, Belgium, New South Wales, Pennsylvania, West Virginia and other States of the American Union. The latest word in the way of regulations came from the Province of Alberta, which only last September put into force its code. On the whole we found the English rules very much more suited to our conditions than those of any other country or state, and in the regulations we submit it will be found we have followed the English rules more closely than any others. We did this advisedly. In this Province we have not had sufficient experience in the use of electricity, either from the point of view of time or number of collieries using it, to frame with any confidence regulations based on that experience alone. The English rules are the carefully prepared result of the labors of two commissions, and embody the experience gained from longer and much greater use of electricity than we have had. So fully and well do they meet conditions usually met with in mines that they were largely followed in the set proposed as standard by the Bureau of Trade and Commerce, Washington; and the Province of Alberta adopted them practically without 'change.' They are constantly being revised and kept up to date, so that by having our regulations modelled upon them we not only have the benefit of their past experience in England, but are in a position to take advantage of any change or amendment the large and enlarging experience in that country shows to be necessary."

The commission is to be congratulated in the business like brevity of its report, which, unlike many similar publications, is compact and concise in its utterances.

The Cottonwood Coal Company has awarded to the Roberts and Schaefer Company, of Chicago, a contract for a complete fireproof coal tipple and coal washing plant to be erected at their new mine at Lehigh, Mont., the Cottonwood Coal Company being the coal department of the Great Northern Railway.

The tipple will have a capacity of 3,500 tons per day and will be built to accommodate both self-dumping cages and mine skips, and is to be equipped with modern coal screening and picking facilities, with electric motor drives throughout. The coal washery, having a capacity of 2,000 tons daily, will be built of reinforced concrete and steel, and equipped with facilities for coal drying, and will be electrically operated throughout. The contract price is $125,000.

The Roberts and Shaefer Company has recently issued an illustrated bulletin on coaling plants.

THE GREAT CHINA CLAY DEPOSITS OF CORNWALL, ENGLAND

By Arthur Lakes.

On my first visit to these celebrated deposits at St. Austell some thirty years ago development was in its infancy. The evidences of prospecting work then in progress were milky streams issuing from the granite hills and whitening the waters of the rivers. Since then the china clay industry of Cornwall has grown to be the greatest and most celebrated of its kind.

On leaving the quaint little town of St. Austell we were at once in the heart of the china clay field. On either side of the valleys, and on the hills and surrounding country as far as the eye can reach, are enormous gray dumps representing the worthless debris thrown out in developing the clay from great crater-like pits or "gloryholes" two or three hundred yards in diameter and several hundred ft. in depth. The scene reminded one of pictures of the surface of the moon with its multitudinous craters and mounds.

Ancient Carclase Tin Mine, now a Clay Pit. "Overburden" is Granite. Tin veins traverse both clay and the overlying granite

The existence of the clay has been known for over 100 years, but the industry dates over the past 50 years. The clay is derived from the decomposition of granite.

Along our road we passed several clay tanks under large sheds called "drys," and open tanks where the milky streams from the quarries and hills are allowed to settle and the impurities are removed. The clay when sufficiently dried and consistent is cut up in blocks, shovelled onto railroad cars and transported by special steamers over the world from sea ports in the vicinity.

Towards the eastern outskirts of the district were a great number of huge clay pits. Some of these quarries are worked for china-clay only, others for what is called "China Stone" or "Cornish Stone" a partially altered granite, composed mainly of quartz and feldspar. This rock is ground under millstones and the ground-up material of quartz and feldspar, resembling commercial salt, is shipped without washing. It is used exclusively for the manufacture of chinaware. Near the bottom of some of these pits was a zone of china stone stained purple by fluorspar. This "purple-rock" is in great demand for china manufacture.

Although from 20 to 300 ft. is the average available depth reached in the pits, this by no means represents the full depth of the clay deposits. Borings have been put down 500 ft. or more without bottoming it. It some quarries a series of closely parallel tin-bearing lodes outcrop and cut down through the clay measures. It is significant of the origin and decomposition of the clays that the principal clay zones run parallel with the principal tin veins of the country. Heated solutions and gases that were connected with the formation of the tin veins, rising from great depths through fissures, doubtless decomposed the rocks adjacent to the veins and formed the china clay. Fluorspar and tourmaline minerals originating through the agency of fluorine and boracic gases, found common to both tin veins and china clay, point to the same origin for both.

In some of these quarries, clay was being broken up and washed down into "sand pits" or "Micas" where after a process of purification, it was pumped to the surface by Cornish pumps which also drained the pits.

After examining the eastern section of the field in the neighborhood of Trevistock, we drove to Henbarrow district, typical of the western division. This region is the highest in Cornwall, attaining an altitude of upwards of 1,000 ft. above sea level. It consists of rolling hills and moors dotted over with clay dumps and pits, with rivulets of milk-white water pouring down into the river below.

Typical of the clay-pits is the "Carclase mine" which was worked by the Carthaginians and Phœnicians as a tin mine whilst to-day it is developed for clay alone. A number of tin leads and quartz veins appear in parallel courses on the sides of the pit, cutting through the granite 'overburden' down into the clay beds beneath.

Near the bottom men were breaking down the clay with broad-bladed mattocks called "Dubbies." The workers are aided by water-falls from a flume above. The broken-up and partially dissolved clay is washed down into a "Sand pit" where the quartz of the granite is separated by precipitation. Thence the partially purified clay passes on into long vats called "Micas"

or "Mica-drags" where the mica is precipitated and got rid of, leaving the clay nearly pure. The purified material in some cases passes down into a pit or shaft below the bottom of the workings as at Carclase, thence through a tunnel in the hill to the neighboring village or else is pumped direct to the surface by Cornish

Shipping China Clay, Fowey, Eng.

pumps and descends by gravity through earthenware pipes to the same place. There it settles in large open, as well as covered, tanks or "Drys" till it has attained sufficient consistency to admit of being broken up and shovelled on the railway cars and taken to the nearest sea-ports.

Analysis and uses of china clay.—China clay is a hydrated silicate of alumina.

An average analysis gives:

	Per cent.
Silica	46.32
Alumina	40.27
Carbonate of Lime	.36
Magnesia	.44
Water	12.67
Loss	.20
	100.00

In its natural state the clay is plastic and gritty, the latter due to grains of quartz.

About 60,000 tons of china stone is annually produced. The output of china clay in 1809, twenty-nine years after its discovery, was 1,700 tons and in 1908 721,416 tons. At the present it approaches 1,000,000 tons.

There has been great increase in the industry within the past few years. New lands are still being taken up and new clay pits opened. This industry has far outstripped in value and importance the time-honored industries for which Cornwall was formerly noted such as the mining of tin, copper and lead.

The chief shipping ports in Cornwall are at Fowey and Charleston, by special steamers, carrying each some four to five thousand tons, to American and various other parts of the world. The clay is shipped in bulk or in barrels, each barrel holding 1,000 lbs. of clay.

Origin of the Cornish china stone and china clay.—These remarkable deposits are derived from the subterranean decomposition of the native granite on a vast scale. This decomposition was not due as might have been supposed to surface waters percolating downwards from above; but from heated waters and gases ascending from below. This is clearly shown in many of the pits where a heavy overburden of hard massive or partially altered granite has to be passed through to reach the underlying clay.

Origin of China Clay.

At an early period, heated magmatic waters and gases arose from great depths into the granite and, whilst filling its cleavage cracks and fault-fissures with solutions of tin and silica decomposed the surrounding granite on a vast scale and to an unknown but great depth. By elimination of the alkalies and silica of the feldspars, partially altered and completely decomposed granite resulted, the one in china stone the other china clay or kaolin.

The History of china clay and the Cornish deposits.—"Kaolin," the technical name for china clay, is from "Kaolong" or "Kauling" a hill near King-tibichin in China, where the clay was first discovered and worked. Kauling means a lofty hill or ridge. The clay from this locality was first sent to Europe by a Jesuit Missionary in the early part of the 18th century. A similar white clay was later found at Ane near Schneeberg in Saxony and used in the manufacture of porcelain, laying the foundation of the celebrated Dresden-ware. It was also found near Limoges, France. In England kaolin was discovered in Cornwall in 1755 and "hard-paste" china was manufactured at Plymouth and Bristol in 1760.

The Chinese used the clay for domestic ware. The process was kept secret, till revealed by Jesuits. China gave the name to the clay. The word "Clay" is from the German "Klei" meaning to stick. Porcelain is an Italian word. Porcelain was unknown in England until specimens were brought from China. The possibilities of British deposits were long unknown and unrecognized. The first efforts in porcelain manufacture were from imported clay and not until Wedge-

Mica Drags, North Rose Co., Cornwall, Eng.

wood's day were the natural china clay resources of Cornwall appreciated or used. Porcelain was called "Chine" in India and the East. It was also known as "Chiney," "Cheney," and "Chaney."

The discovery that the ingredients used by the Chinese abound in Cornwall was by a young Quaker,

William Cooksworthy in 1755. Being interested in the manufacture of porcelain he experimented with the stone of Cornwall and Devon and established a pottery at Plymouth in 1760.

During the fifteenth and sixteenth centuries china porcelain found its way into Europe. The Florentines copied the Chinese. The Jesuit, father Pere Entrecolles, introduced china clay into Europe in the eighteenth century.

Shipping China Clay, Fowey, Eng.

China clays have been discovered in Pennsylvania and North Carolina, in Saxony, Bohemia, France Russia and Sweden, usually derived from decomposition of granite, but sometimes simply from that of Cretaceous strata. The better qualities of Cornish clay are unequalled elsewhere.

Kaolin gives plasticity to the china paste and secures retention of form for the ware in the kiln. Petunzite or china stone gives translucent qualities to porcelain.

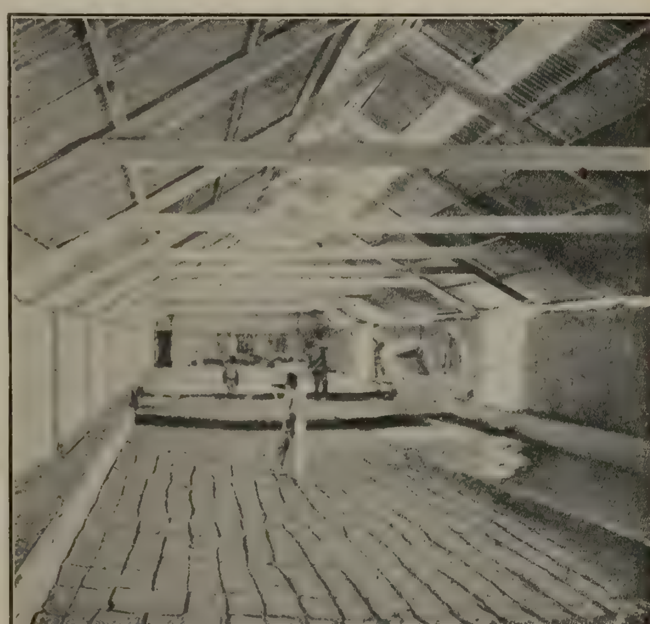
Uses of china clay.—Besides for porcelain, it is principally used in paper-making, rendering the paper smooth and opaque; it is readily incorporated in the fibre and it adheres closely to it. It is also used in cotton-sizing and bleaching, in alum-cake, linoleum, floor-cloth, ultramarine, asbestos-rubber, soap, oil, paint and chemicals. The main use of china stone is in strengthening the body of porcelain and glazing.

Modes of development and working of china clay mines.—The first thing to determine in new china clay property is whether there is sufficient depth and area of clay to be worth working. This is proven by boring and by trial pits. A shaft, called a "washing shaft" is then sunk in the centre of the clay area and to the bottom. Another called the "engine shaft" is sunk on the edge of the deposit to accommodate a Cornish pump. A tunnel is driven connecting the bottom of both shafts. The overburden, which may be from 10 to 50 ft. thick or more of "meat" earth "Killas" or granite is then removed from around the top of the "washing shaft" by tram-wagons. Water is brought in at different points to wash down the uncovered clay until the deposit is exhausted.

For washing, water is brought by wooden conduits or launders. Before turning on the stream a portion of the exposed bed is broken up by "dubbies" or large broad bladed mattocks. The track caused by this breaking up is called a "Streak." A stream of great force is let down over the area of the streak. Water separates the clay and mica from the sand and stones. At the bottom of the pit quartz sand is caught in framed pits called sand pits or drags. Some clay or mica continues its course over the drags until the washing shaft is reached, down which it flows and thence through the connecting level into the bottom of the pumping shaft. Running water holds the clay and mica in suspension. The coarser grains of quartz are deposited in the drags at the bottom of the mine. Lighter particles of clay pass on in a milky stream into the washing shaft. The clay in suspension is pumped up from the bottom of the pumping shaft to the surface and carried by earthen pipes to the entrance of the micas which occupy a series of parallel channels. These mica drags usually about 200 ft. long, 2 ft. deep and divided lengthwise, bring about total separation of the clay from the mica in suspension. Fluid clay comes out of the pipe running from the works and, entering the micas from the top end, is distributed over the whole area. The stream at the end of its course passes through copper gauze mesh 3,000 holes to the inch. Mica extracted by gravitation is used for coarse goods.

Clay tarnished by mica is of inferior quality. Sometimes when the clay it opened on the top of a steep hill it is not pumped up from the bottom of the pit. but comes out on the hillside through a tunnel from the pit bottom, the clay running in the "micas" at the lower level. The common 'Cornish-engine' pump of Bolton and Watt type of a century ago is used to a depth of 300 ft. Electric power is now being introduced in some of the mines.

The drys.—These consist of open as well as covered tanks of rectangular shape. At Charleston harbor is a good example of receiving tanks and drys and also of the mode of shipping in special steamers. White clay pours down as a liquid from the hills above the port openly or through pipes into the receiving tanks. These are a series of large rectangular structures, 8 to 10 ft. deep and over 100 ft. long. In total length they are 280 ft., which is the length of the adjacent shed covering the dry tanks preparing for shipping.



Drying Clay, Cornwall, Eng.

In this shed the tanks are 18 ft. wide, 5 to 6 ft. deep, paved with broad fire-clay tiles resting on a series of

flues traversing the dry from end to end, cross-wise. Heat is supplied from a furnace at the end of the building. The clay from the receiving tanks just above the drys passes into the latter in a liquid stream like cream and spreads out and accumulates on top of the tiles to a thickness of 6 or 8 ins. When this layer has by drying attained the consistency of cheese or butter, it is cut up in blocks and shovelled into the railway cars below the dry and thence it is taken to a steam boat. The water contained in the liquid clay of the upper or receiving tanks is let out by wooden plugs. The clay may be left to settle in the receiving tanks for four to six weeks. When the clay in the dry is sufficiently consistent, wagons are run onto a platform, movable along the entire length of the building, so the clay can be placed at any required spot. It is divided into blocks of a suitable size for lifting on a shovel and may be removed to a linhay or store-room to admit of the moisture being driven off more rapidly. Drying takes from one to three days. Too rapid heating of the flues takes the nature out of the clay. Dry clay from the linhay is either sent away in bulk or packed into sacks or barrels. From the time the china clay is washed to the time it is dried is about six to eight weeks.

In preparing this article the writer is indebted to the various china clay companies at St. Austell and particularly to the North & Rose Co. for illustrations and other data, also to Mr. W. Cune for guidance over the area and for much scientific and geological information.

PERSISTENCE OF ORE IN DEPTH*

By J. B. Tyrrell.

I have read with great interest Mr. T. A. Rickard's paper on the "Persistence of Ore in Depth," and join in thanking him for his excellent collection of instances of decline and final disappearance of orebodies in mines in all parts of the world, and also for his record of the opinions of miners with whom he came in contact from time to time while these mines were gradually dying out; though it is a pleasure to know that during the same time more new mines were being discovered, so that at the present time the production of the mines of the world is greater than it has ever been before.

In his paper Mr. Rickard starts the battle, and does not fail to exercise the prerogative of the challenger in choosing the weapons.

His first weapon is the term 'ore,' and the primary condition imposed is that it must be extracted at a profit or it is not ore. A narrow vein containing 1 oz. of gold to the ton near the surface in a country of soft rock might pay to extract, and, consequently, would be 'ore,' while the same vein at a greater depth in a hard country might contain 2 oz. of gold to the ton but would not pay to extract, and, consequently, would not be 'ore.' In such a case, while the gold content of the vein had doubled in quantity, the 'ore' would not persist in depth.

Such an irrational definition complicates the question at issue, and will deprive the discussion of some of its value, but, nevertheless, Mr. Rickard has defined the subject, which he allows us to discuss, and we must abide by his decision.

Among the definitions it is unfortunate that the class of orebody to be discussed has been left uncertain. It would hardly be worth while for anyone to write a paper with the object of proving that orebodies formed by secondary enrichment do not persist in depth, for every miner at all conversant with his subject knows that they do not. On the contrary, there are few who would have the hardihood to assert that magmatic segregations, such as the nickel-copper orebodies at Sudbury, do not continue to great depths, for the acknowledged method of their formation would indicate persistence downwards with the margin of the norite laccolith with which they are associated, and no proof has yet been offered that would indicate a contrary set of conditions.

The title of the paper does not state whether the author intends to use the surface of the earth as the starting point from which to measure the depth to which ore persists, but the whole tone of his paper would indictate that this is his intention. Now, the present surface is an accidental or fortuitous section through the rocks which compose the earth's crust, and on account of either sedimentation or erosion, which is constantly in progress, is a different plane from the surface at the time when any orebody was formed. The difference may be slight or it may be great, but it is different. If the surface at the time had been the controlling factor in the deposition of the ore, or had been the datum plane from which the ore was deposited, that datum plane is now either above or below the position which it occupied at the time of ore deposition. In the case of most secondary enrichments, where the surface has exercised a controlling influence in their deposition, and where that surface has since been subject to erosion, the controlling datum plane was above the present surface. In the case of many primary deposits formed in fissure veins by ascending solutions, the cause controlling deposition was at an unknown but often great distance beneath the surface, and this controlling cause or datum plane may have had no relationship whatever to the surface as it then existed, and may have been far beneath it.

In some cases the datum plane, while beneath the surface at the time of the formation of the deposit, is now partly beneath and partly above the present surface.

The Cobalt Silver Deposits—An excellent example of this condition may be seen at Cobalt, in Northern Ontario, where a sill of coarse diabase, about 500 ft. thick, was intruded into pre-Cambrian rocks of Keewatin and Huronian age. Both the lower and upper surfaces of this sill were planes from which the silver-bearing veins extended more or less vertically at right angles to it, so that if the sill with the dependent veins could be lifted up these veins would be seen hanging as series of fringes from its lower surface.

Erosive agencies have removed the rock which formerly covered this sill over large areas, have bevelled off the sill itself to an edge, and have removed it completely with the over-lying rock over other large areas. Most of the veins which have been worked up to the present time are in the area from which the sill was completely removed, though they are sufficiently near its edge to indicate that they must have been close to its lower surface before its removal. Veins so situated were easily discovered, but the discovery of veins which are still beneath the sill, and have not been exposed by the removal of the sill through processes of erosion, is a much more difficult matter, because it necessitates the driving of expensive tunnels and cross-cuts through the hard underlying rock. However, some such veins have been discovered. The first one that came under my observation was in a mine just east of the Nipissing property. It terminated upwards at the lower surface of the diabase sill, and extended thence downwards into the underlying rock.

In the south-eastern portion of the Cobalt area the surface has not been eroded down to the diabase sill,

*A contribution to discussion of a paper by T. A. Rickard, published in February Bulletin of the Institution of Mining and Metallurgy.

and there the ore was found to extend upwards from the diabase sill towards the surface, but not to the surface. In this district very rich ore has been found at a depth of 650 ft. below the present surface, which is considerably deeper than the 400 ft. recorded by Mr. Rickard.

Considered generally, the mode of occurrence of silver ore at Cobalt is typical of rich veins which have been formed beneath the surface, but, as far as is known, quite independent of surface agencies. The datum planes to which the ore must be referred are the upper and lower surfaces of the diabase sill, and not the present surface, and as the ore does not persist for more than a few hundred feet from these datum planes, where these planes are close to the surface, the ore-bearing veins naturally do not extend to great depths. Whether similar veins would be found at great depths, if the upper or lower surface of the sill were followed where it dips under the overlying rock, is not known.

Even the Lake of the Woods, to which reference has been made, can furnish some evidence relative to the downward extension of orebodies, and the independence of the datum plane controlling deposition from the present surface.

One mine which I examined, and which for a time had been worked at a profit, was found to have a strong well-defined quartz vein near a contact of a porphyritic granite with green schist. This vein had been followed to a depth of several hundred feet, and several thousand feet of drifting had been done on it. It was found to contain some gold throughout with an average tenor of about 1 dwt. to the ton, or perhaps less. In its deeper portion it was in the granite, but higher up it crossed the contact into the greenstone, and at the contact was constricted. Below the constriction there was a decided enrichment of the vein forming a well-defined ore-shoot. The line of constriction was pitched at an angle of 25°-30° to the horizontal, which brought it to the surface, while at its lower end it opened up and the ore-shoot disappeared. In this case the datum plane which controlled the formation of the orebody would appear to have been the constriction at the contact, and the present surface was merely an accidental section through this constriction, without any apparent relationship to the extent of the orebody.

Extension of veins—In considering the extension of ore-bearing veins, the datum planes controlling deposition must be given first consideration, even though, for purposes of mining, these datum planes may need to be reduced to the present surface of the earth. But the conditions of vein formation have been so varied, and, in many cases, especially where the ore has originated from deep-seated sources, are so obscure, that a generalization, covering either the vertical or lateral extension of orebodies, which uses as its principal factor an artificial plane like the present surface, instead of the structural datum plane which controlled deposition, is certain to be erroneous, and deductions drawn from such a generalization will be 'scientifically untrue.'

The author's method of sweeping aside all evidence and simply asserting his belief that most ore deposits are of recent origin will hardly carry conviction to thoughtful mining engineers. Instances in which the gold, or other valuable material for which a mine may be worked, has been determined to have been deposited at but a slightly later date than the gangue of the vein in which it occurs must be known to everyone, and it is not necessary to enumerate details of evidence here. However, I might mention one of many instances. In the pre-Cambrian rocks of the Porcupine district of Northern Ontario, gold-bearing quartz veins occur in basaltic greenstones and sericitic schists. The most recent rock in this pre-Cambrian complex is a basic syenite which, in the form of a dyke, cuts across the schists with its contained gold-bearing veins, and is evidently later than the introduction of gold into the vein, showing that enrichment was confined entirely to pre-Cambrian times previous to the intrusion of this dyke.

Mr. Rickard's brilliant paper on the mortality of mines reminds one rather strongly of the sickness and death of human beings, and the general tone of his paper would suggest a farther comparison with the occurrence of human diseases, leaving one with the thought that as a man must die it is not worth while for the doctor to attempt to prolong his life by endeavoring to heal the disease from which he is suffering. As with many human beings, so with many mines, it might be found that a closer study of the diseases from which they are suffering would lead to a better knowledge of the causes of those diseases and of the means to be adopted in rectifying them where such rectification was possible. In undertaking the investigation and study of the orebodies of such mines the investigator must approach the subject in a scientific spirit of complete independence from unproved theories, whether those theories refer to the persistence or non-persistence in depth of the ore or to some of its other characteristics. After the examination is completed the honest valuator or investigator will state the results of his investigations candidly, whether those results may happen to agree with the confirmed and pessimistic opinions of others or not.

The paper will doubtless serve a useful purpose in repeating a warning to the public, a warning which has been given many times before, though rarely with such elegance and force, against the value of optimistic reports on mines and mining properties made by interested parties who are ready to certify to the indefinite extension of their orebodies in all possible directions. However, it will lose a large portion of its value to either the public or to mining engineers if it serves to encourage a cynical disbelief in sound evidence of the existence of bodies of ore, no matter where situated, until that ore has been actually raised to the surface.

ALBERTA PETROLEUM CO.

At the annual meeting of the Alberta Petroleum Consolidated Company, the financial statement presented disclosed that the company had in the bank $30,267.49; accounts collectable $3,357.02, and a $5,000 credit with the Northwest Drilling Company to be used against further drilling contracts with that firm.

In addition the company has 60,000 acres leased. seven drilling outfits, and $27,000 worth of casing.

It was announced by the president that a pooling agreement, covering 2,566,000 shares, had been arranged, and that a large number of the big shareholders had agreed to contribute a portion of their holdings to a common fund, to be sold later should occasion warrant it. He stated, however, that there were still in the treasury 6,600,000 shares for further development.

In conclusion he mentioned that the company had 8.176 shareholders, and that 24,420 certificates had been issued.—Journal of Commerce.

NON-METALLIC MINERALS USED IN CANADIAN MANUFACTURING INDUSTRIES*

By Howells Frechette.

The rapid industrial growth which Canada has been undergoing in recent years has greatly increased the demand for the non-metallic minerals and is constantly affording new uses to which they may be applied. In many of the manufacturing industries, minerals, in a more or less crude state, are used as raw material or, indirectly, as a means of producing the products of the factory.

An unduly large proportion of the mineral used in these industries is imported. In some cases the importation is necessary or advisable, since some minerals and particular grades of others are not obtainable at present in Canada, or the material may be obtained from abroad for less than the cost of production and delivery of the Canadian. In other cases, however, it is due to the fact that the domestic products are not always prepared in the form most suitable for the purposes for which they are required. Frequently the buying and selling methods in use are at fault. For example, the Canadian producer, through lack of capital, is often at a great disadvantage, being unable to advertise extensively and thus attract attention to his product and secure a trial of it, even though his price be lower and his product as good or better than the imported article. During the gathering of data for this report it was found, in many cases, that the consumers of certain minerals were not aware that these were produced in the country, often quite close at hand. In such instances a list of the producers and their addresses was furnished.

There are a number of trade journals which reach the manufacturers, and it would seem that even small advertisements judiciously placed by the Canadian producers would aid greatly in increasing the amount of domestic minerals used in our manufacturing industries.

The greatest bulk of imported minerals comes to this country from the United States. The American producers and jobbers have standardized their products and established grades with trade names, which they have brought to the attention of the consumers in this country by persistent and systematic advertising and efficient selling methods. Their goods have been tried and become known to the manufacturers, who, when satisfied with the results, have been loth to experiment further.

A great many manufacturers know little concerning some of the raw materials which they use, the selection of which is frequently left to the judgment of the supply firm with which they deal, or else is based on an original trial shipment. It is very seldom that specifications are used in purchasing. The orders are made to read "same as last shipment," or "suitable for such and such a purpose."

Since the organization of the Mines Branch, numerous inquiries have been received with regard to the demand for non-metallic minerals; the uses to which they are applied; and the requirements of consumers with regard to purity and physical properties. In many cases, these inquiries were difficult to answer, owing to the lack of an intimate knowledge of the Canadian market and its requirements. In order that such data might be available I was commissioned to visit the manufacturers throughout the Dominion, with instructions to obtain from them as much information as possible regarding the non-metallic minerals used by them; the quantity of each consumed per year; the price delivered; and the source of supply, whether domestic or imported.

Asbestos—In this country the principal manufactures of asbestos are mill board, paper and shingles, for which purpose a short fibre is used.

In the making of certain mineral flooring short fibre asbestos enters into the mixture, where it acts as a binder.

On account of its low electrical conductivity it is used as an insulator in electrical instruments. While asbestos paper and mill board are principally used for this purpose, considerable long and short fibre are also employed.

Short fibre is mixed with paints to produce a fire resisting paint. It is also used in making stove cement, pipe covering, etc.

Long fibre, besides the uses referred to above, is used in making gaskets for packing glands and pipe joints where high temperatures or acid solutions are encountered, making of chemical and water filters, and as a surfacing of gas grates.

Asbestic is a name applied to impure very short fibre asbestos. It is used by plasterers, manufacturers of roofing, and also for a number of the purposes referred to above.

Barite is used for three purposes by paint manufacturers.

1. As a "filler" for white lead and other paints. It was first employed purely as an adulterant both on account of its weight and its cheapness as compared with the white lead with which it was mixed. Later it was recognized that it had properties which gave to the paint certain advantages. For example, the fine angular grains were found to give to the surface of the paint a "tooth" which offered a good bond to subsequent coats. It also adds to the life of the paint, since it is unaffected by weather and chemical fumes.

2. As a vehicle for color in paint making. In "The Barytes Deposits of Lake Ainslie and North Cheticamp, N.S.," Henry S. Poole says: "The fitness of barytes as a pigment is due not merely to its weight and absence of color, but to its aptitude to take color-stain uniformly and make a small quantity of a decided color cover much surface, a property not equally borne by other white substances, such as gypsum and marble, which the manufacturers of barytes for the market find it desirable to remove by special treatment. Barytes acts as a base for aniline and certain other pigments."

3. For putty making. Putty is often made by simply mixing whiting and linseed oil to the consistency of dough. By substituting barite for part of the whiting a lesser quantity of oil may be used to produce the same bulk, thus saving on the price of oil.

For the above three purposes the barite is ground to the fineness of flour, and in the case of the first two it is also lixiviated, as described later, in order to remove any stain.

*Extracts from a report published by the Mines Branch, Ottawa, 1915.

Rubber manufacturing. Barite is used for "weighting" or "filling." For this purpose the mineral is very finely ground, but need not be lixiviated as the color is not of much importance. The presence of barite, it is claimed, is desirable in rubber up to a certain percentage, as it adds to the resiliency and the durability of the product.

Textile manufacturing. A very small quantity of finely powdered lixiviated barite is used in Canada for filling cotton goods.

Wall paper manufacturing. Barite is used in the preparation of certain pigments employed in the printing of wall paper. The colors are precipitated on barite. For this purpose the mineral is finely ground and lixiviated. Absence of color is essential.

Tanning industry. In the finishing of some leathers barite enters into the composition of the dressing. For this it is finely ground, but need not be lixiviated.

Chemical manufacturing. Barite is used as a source of barium in the manufacturing of various chemicals.

In addition to the above uses to which barite is put, it has been stated that it is used to some extent as an adulterant in candy making, etc. This is, of course, not legitimate. The writer is not aware of any being used in Canada for this purpose.

Limestone, dolomite, and marble are very valuable as building stones, not only on account of their strength and appearance, but because of the ease with which they may be wrought into shape. Lime, the calcined product of these stones, is also a valuable building material. In fact, the principal use of lime is for this purpose.

From the standpoint of the amount consumed and diversity of uses in the industries, no other non-metallic mineral products, except coal, can compare with limestone and its group. The various industries employing them will be dealt with individually and their requisites stated briefly.

The following table from the chapter on lime in the "Mineral Resources of the United States" serves well to show the many uses to which lime is put, and also indicates the type of lime preferable in each case.

Chemical Uses of Lime.

Agricultural industry—As a soil amendment, c, m; as an insecticide, c, m; as a fungicide, c, m.

Bleaching industry—Manufacture of bleaching powder, "chloride of lime," c; bleaching and renovating of rags, jute, ramie and various paper stocks, c, m.

Caustic alkali industry—Manufacture of soda, potash and ammonia, c.

Chemical industries—Manufacture of ammonia, c; manufacture of calcium carbide, calcium cyanimid and calcium nitrate, c; manufacture of potassium dichromate and sodium dichromate, c; manufacture of fertilizers, c, m; manufacture of magnesia, m; manufacture of acetate of lime, c; manufacture of wood alcohol, c; manufacture of bone ash, c. m; manufacture of calcium carbides, c; manufacture of calcium-light pencils, c; in refining mercury, c; in dehydrating alcohol, c; in distillation of wood, c.

Gas manufacture—Purification of coal gas and water gas, c, m.

Glass manufacture—Most varieties of glass and glazes, c.

Milling industry—Clarifying grain, c, m.

Miscellaneous manufactures—Rubber, c, m; glue, c, m; pottery and porcelain, c, m; dyeing fabrics, c, m; polishing material, c, m.

Oil, fat and soap manufacture—Manufacture of soap, c; manufacture of glycerine, c; manufactures of candles, c; renovating fats, greases, tallow, butter, c, m; removing the acidity of oils and petroleum, c, m; lubricating greases, c, m.

Paint and varnish manufacture—Cold-water paint, c, m; refining linseed oil, c, m; manufacture of linoleum, c, m; manufacture of varnish, c, m.

Paper industry—Soda method, c; sulphite method, m; for strawboard, c, m; as a filler, c, m.

Preserving industry—Preserving eggs, c.

Sanitation—As a disinfectant and deodorizer, c; purification of water for cities, c; purification of sewage, c.

Smelting industry—Reduction of iron ores, c, m.

Sugar manufacture—Beet root, c; molasses, c.

Tanning industry—Tanning cowhides, c; tanning goat and kid hides, c, m; water softening and purifying, c, m.

(Note—High calcium lime is indicated by "c," magnesian and dolomitic lime by "m.")

Aerated water and carbon dioxide making. Whiting and magnesite are used for the production of carbon dioxide (CO_2), which is principally used for the purpose of aerating beverages. On adding an acid to whiting, carbonate of lime, the acid forms a new salt with the lime and liberates carbon dioxide, which is collected under pressure. In some cases marble dust (stone flour) is used in place of whiting.

As will be pointed out later, the majority of users of magnesite employ it in the calcined form. During calcination it gives off carbon dioxide equal to about half its weight. When the calcining is done in retorts the gas may be saved and stored in iron cylinders, under pressure. Much of the carbon dioxide used in Eastern Canada is produced in this manner. It must be regarded only as a by-product of the calcining, since the calcined magnesite, or magnesia, is the more valuable of the two products.

Where the carbon dioxide is used for aerating beverages the materials from which it is made must not contain any impurities which would give off poisonous or objectionable gases during the treatment. Sulphides and arsenides should not be present except in very small quantities.

Artificial stone and mineral floor making. In the mixture of which the exposed face of artificial stone is made, crushed calcite, crystalline limestone and marble are used. The material should be crushed to pass through a twenty mesh screen. White is the color usually specified, but other colors, including black, are occasionally used to obtain the desired effect. The presence of minerals, which on weathering would produce stains, is objectionable.

Magnesia is one of the principal ingredients in one type of mineral floors. It is mixed with marble dust and other materials and bonded by means of magnesium chloride.

The presence of lime is deleterious, since it tends to bleach any coloring matter added to the mixture and to cause swelling and cracking of the finished floors. Over five per cent. of lime, three per cent. of carbon dioxide, or four per cent. of moisture renders magnesia unsuitable for this purpose. It should be very finely ground.

Terrazzo flooring is made with small chips of marble embedded in cement. Various colors of marble are used. The fragments should be of fairly uniform size. It is graded into a number of sizes, ranging from a quarter of an inch to an inch and a half in diameter.

Sand-lime brick making. Sand-lime brick is manufactured by pressing a mixture of sand and lime into

shape under great force and then subjecting the brick to the action of steam under pressure for several hours. Both high calcium and magnesian limes are used, but the better results are obtained from the former. Argillaceous matter is inert under the conditions of this process, and its presence simply reduces the quantity of available calcium, or magnesium oxide, per ton of lime. Free silica acts as the silica of the sand to which the lime is added; thus it is of no advantage and reduces the percentage of the active agents in the lime. In general, the purer the lime the better it is.

Button manufacturing—Whiting is used as a polishing material for pearl buttons. It should be free from grit and very fine.

Cement manufacturing—In the manufacturing of cement large quantities of limestone are used. The cement companies usually supply themselves from their own quarries. The limestone should not contain over five per cent. of magnesium carbonate. Ferric oxide should not be so high as to analyze over four per cent. in the cement. Free silica is objectionable. In "Portland Cement," by Richard K. Meade, M.S., he says: "In determining the suitability of a limestone to be used in the manufacture of cement, it is necessary to take into consideration the shale or clay which is to be used with it, as in every case it is the mixture of the two, made in proper proportions, which must have the right composition. . . . ."

In the manufacture of slag cement slaked lime is mixed and ground with blast furnace slag. A high calcium lime is required.

Calcium carbide manufacturing.—On heating lime to a high temperature, in an electric furnace, in the presence of a definite quantity of coke, a chemical union takes place between the calcium of the lime and the carbon of the coke, forming calcium carbide (CaC_2). As pure a lime as possible is required. Magnesia should not exceed three per cent.; some manufacturers specify one per cent., or less. The lime should be free from sulphur, phosphorus and arsenic. Iron and silica should be low. The total impurities, including magnesia, should be under five per cent.

These same specifications apply to lime used in preparing cyanamid.

Pharmacists and chemical manufacturers—Lime, chalk and magnesite are used for a number of purposes in the chemical industry. For practically all of these purposes, the purest obtainable material is demanded.

Illuminating gas works—Illuminating gas, as it leaves the retorts, carries with it certain impurities which must be removed before it is fit to turn into the service mains. The gas is passed through beds of hydrated lime, which combines chemically with certain of these impurities and removes them from the gas. The calcium oxide is the active agent in this operation, and, therefore, the high calcium limes are most desirable.

Lime is also employed in extracting the ammonia from the ammonia liquor which is a by-product of gas making.

Electrical goods manufacturing—Marble is used, in the form of polished slabs, for the mounting of instruments for switch boards. The marble for this purpose should be free from electrical defects; that is, it should be free from graphite, pyrite and other electro-conductive minerals. The presence of seams of quartz is objectionable, since they are likely to cause deflection of the drill when holes are being bored.

Marble dust is used in the mixture of plaster of Paris for cementing incandescent lamp bulbs into their metal sockets. It should be finely powdered and free from large particles. Whiting is used also for this purpose, and in the making of dry batteries.

Hydrated lime enters into the composition of the insulation for electric wires. A high calcium lime is most desirable.

Manufacturing of explosives—In the manufacturing of one kind of high explosive chalk is used. It must be very pure—absolutely free from siliceous grit.

Foundries—In many foundries limestone is added to the cupola charge as a flux for the siliceous matter of the coke ash, and the sand adhering to the pig iron. Little attention is paid to the composition of the resulting slag from the foundry cupola, and, therefore, as one might expect, little attention is paid to the composition of the limestone used. The limestone employed is almost always that which is most easily obtained. A fluid slag may be produced with either a high calcium limestone or a dolomite. The stone should be low in silica, since the silica contained will require part of the lime to slag it, thus reducing the quantity of available lime.

Glass manufacturing—Calcium oxide is one of the principal constituents of several kinds of glass. It is added to the glass mixture in the form of limestone or lime. Most producers prefer the latter, as the evolution of the carbon dioxide of the former is liable to cause flaws in the finished product. A high calcium content is essential. Magnesia, alumina and iron are objectionable. For the making of the better grades of glass there should not be over three-tenths of one per cent. of iron oxide, or the equivalent amount of iron, in the raw limestone; for lime, one-half of one per cent. is the limit.

Match manufacturing—Magnesia and whiting are used in compounding the mixture for the heads of matches. A fairly pure material is required, and should be very finely ground.

Glue and fertilizer manufacturing—In the manufacturing of glue and fertilizer lime is used. The purity of the lime is not a matter of importance, except in its effect on the percentage of calcium oxide and magnesia available.

It is said that lime for fertilizer purposes should contain sufficient magnesia to make its ratio to the calcium oxide as four is to seven.

Metallurgical works—In the extraction of metals from their ores by smelting, the metals are reduced to the metallic form or converted into sulphides, called mattes. The gangue minerals of the ore and the ash of the fuel must be removed. This is accomplished by smelting with some fluxing material and allowing the slag to flow from the furnace. The nature of the flux depends upon the chemical composition of the material to be fluxed. If they are basic, an acid flux, such as quartz, must be used, but if they are acid the flux must be basic. Being the most active of the cheap bases, lime, in the form of limestone, is most frequently used in the smelting of acid ores.

As already pointed out, under foundries, the limestone should be of low silica content. The desirability or undesirability of magnesia is determined by the particular process of smelting in which it is to be employed. Sulphur and phosphorus are most undesirable, especially in the smelting of iron and the converting of iron into steel. As a rule arsenic is a very objectionable impurity.

In the basic method of steel converting, calcined magnesite is frequently used as a furnace lining, either in the form of bricks or shaped within the furnace from

the ground material. For this purpose it should be very low in silica. Calcined dolomite is also used as a furnace lining.

Oil refining—Lime is used in the refining of petroleum for the purpose of removing acidity from the oil after treatment with sulphuric acid.

The lime may be either high calcium or dolomitic.

Paint manufacturing—Lime, magnesia and whiting are used in the paint industry for a number of purposes, especially in the making of cold-water paints. High magnesian limes are preferred and should be air-slaked or hydrated. They should be very finely ground, free from grit, and as nearly white as possible.

Whiting and finely ground marble are used for making putty and wood filler.

Polish manufacturing—Whiting and very finely ground marble are used in manufacturing certain metal-polishing pastes and creams. Freedom from coarse gritty matter is the main requisite.

The manufacturers of polishes often put up a "sweeping compound," which is principally composed either of sand or crushed calcite. The calcite should be crushed to pass through a twelve-mesh sieve and should be free from dust. The waste product from the concentration of certain ores should be well adapted to this use.

Enamelware manufacturing—Some manufacturers of enamelled metal ware use calcite in the composition of their enamel mixture. For this purpose the calcite should be very pure, containing not more than traces of iron oxide. It should be ground to one hundred mesh.

Pulp and paper manufacturing—Wood pulp is manufactured by two chemical processes, known as the sulphite process and the soda process.

In these processes the wood fibre of which the pulp is composed is bleached and freed from the resins and the cementing material of the wood by means of chemical solutions.

In the first process the solution consists of calcium and magnesium bisulphite, and is prepared by subjecting dolomitic limestone to the combined action of sulphur dioxide and water. Quick lime or hydrated lime may be substituted for the limestone. Both the calcium and magnesium are active agents. The high magnesian limestones are preferred because of the better pulp resulting from their use.

Caustic soda is the active element of the solution used in the soda process. After the treatment of the wood with this solution the soda may be recausticized by means of lime. A high calcium lime is desirable, as magnesia plays no part in the reactions.

Rubber goods manufacturing—In the manufacture of rubber goods, lime, magnesia and whiting are used as weighting materials. They should be very finely powdered (200 mesh) and free from grit.

The grade of whiting generally used is that known as "gilders'." Phosphorus is very objectionable.

Sugar refining—In the manufacture of beet and cane sugar, lime is employed as a reagent in the processes involved. The manufacturers generally calcine the limestone themselves and make use of the carbon dioxide given off.

A high calcium limestone is specified, containing very little magnesia. It should also be low in insoluble matter, iron, alumina and alkali. The alkali should not exceed one-quarter of one per cent. Oyster shells are sometimes substituted for limestone.

Tanning—Lime is used to aid in the de-hairing of pelts preparatory to tanning. A high calcium lime is the most desirable in this process for most kinds of skins, but it is said that magnesia is a valuable constituent for use on goat hides. The lime should be low in iron oxide and insoluble matter. In most cases quicklime is used, but hydrated lime is said to be more satisfactory. Quicklime is liable to become air-slaked, thus losing its caustic property. Hydrated lime absorbs carbon dioxide very slowly when properly stored, hence the loss is likely to be much less from this source.

It may here be pointed out that quicklime requires careful storing to overcome the danger of fire being started from the rise of temperature occasioned by the absorption of moisture. Hydrated lime is not subject to this rise of temperature. Insurance underwriters recognize this and take it into consideration when fixing the rate of risks.

There are a great number of other important uses to which limestone and its allied materials are put, but the above are those of major importance to the Canadian producer.

Chromite is used in the chemical industry for making chromic acid and the various salts of chromium, which in turn are used for making paint and ink pigments and other purposes.

It is also employed as a source of chromium in the manufacture of chrome steel. In this case the iron content is also utilized. Chromite is very basic in chemical reaction and highly refractory, suiting it to the manufacturing of fire bricks for certain metallurgical purposes, and also for the lining of basic open hearth steel furnaces, the only use to which it is put in Canada at present.

When used for refractory purposes silica is an objectionable impurity and should be reduced by concentration to at most five per cent.

Clays—The uses to which clay may be put depend upon its physical properties, such as its plasticity, the effect of drying, its behavior at various temperatures, tensile strength, and its color, both raw and after firing.

Very complete data on the requirements as to composition and physical properties of clays for special purposes may be found in "Clays: Their Occurrence, Properties and Uses," by Professor Heinrich Ries. The description in detail of the various clays of commerce would require more space than is available for the subject, and is outside the intended scope of this report.

In the table of minerals used, clays are divided under the following headings:

(a) Clay—Under this heading are included clays not specified elsewhere, common brick clay, unclassified clays and local clays generally.

(b) Ball Clay—This is a very plastic clay of high tensile strength used in porcelain making to give plasticity to the body of the mix. It must be very low in impurities which would tend to color the finished product, when intended for use in making white ware. It is used also as a bond in abrasive wheels.

(c) China Clay or Kaolin—This is a white clay, consisting, almost entirely, of hydrated silicate of alumina. It is not very plastic as a rule. As its name implies it is used largely in the making of china and porcelain. It is also used as a filler of cotton goods and paper, in the coating of book and wall paper, in the coating of cloth for window blinds and in the manufacture of paints. It also enters into the composition of some mineral floorings.

(d) Fire Clay—Clays possessing a very high refractoriness are termed fire clays. They differ among themselves greatly in many of their physical properties and in composition, but are always low in impurities such as lime, magnesia, iron oxide and alkalies, which are

fluxing materials. When there is a high percentage of uncombined silica in a fire clay it is called ganister. This name is also applied to a silicious rock used in making firebricks. Fireclay should not fuse below 3,000 deg. Fahrenheit.

The uses of fire clay depend primarily upon its refractoriness. It is manufactured into certain classes of firebrick, furnace and stove linings, crucibles and briquettes for gas grates. It is also extensively used for bonding the brick work or boiler settings, cupola and metallurgical furnace linings. The quantities given in the accompanying tables do not include that used for boiler setting, except in a few instances.

(e) Pipe Clay—This is a plastic white clay, relatively high in silica. It is used in manufacturing procelain and enamelware. It is used also in paint making, on which to deposit certain colors. For this purpose it should be free from grit and uniformly white.

(f) Sagger Clay—This clay is used in the mixture for making saggers, the vessels in which porcelain and pottery is placed for burning. The necessary degree of refractoriness varies according to the temperature of the heat the saggers must stand while in use.

(g) Slip Clay—This term is applied to clay used as a glaze for stoneware. It contains a comparatively high percentage of fluxing impurities, and should melt at a low temperature to a greenish or brown glass. This clay is used also as a bond in abrasive wheels.

(h) Stone Clay—This is the name given to the clay forming the body of stone ware. It is usually refractory or semi-refractory and should vitrify without losing its shape. It should be of good tensile strength and sufficiently plastic to work well on the potter's wheel.

Corundum—Owing to its hardness and to the fact that it is not brittle, corundum is admirably suited for use as an abrasive. It is employed for grinding and polishing, both in the form of powder and wheels.

In the making of wheels the grains of corundum are mixed with clay and fluxes and moulded into shape, after which the wheels are "fired" at such a temperature as to establish a strong bond between the particles.

Emery is an impure corundum. It is almost black in color and contains magnetite and hematite intimately mixed.

Its uses are the same as pure corundum, but its abrasive power is very much less.

Cryolite finds its principal use, in Canada, in the electrolytic reduction of aluminum, in which process it acts as an electrolyte. It is used to a small extent in the manufacturing of opal glass.

Feldspar—The main uses of feldspar are in the ceramic arts. Feldspar, either No. 1 or No. 2 grade, is one of the principal ingredients of the body and the glaze of the porcelain. In the body it fuses during the firing and forms a firm bond between the particles of quartz and clay. In the glaze it fuses and combines with the other ingredients to form an opalescent, glassy covering to the ware on which it is applied. Thus it will be seen that the temperature of fusion is an important factor in selecting a feldspar for these purposes. The melting point depends largely upon the percentages of alkalies in the spar. The higher the percentage of potash the lower will be the point of fusion. Where a small part of the potash is replaced by soda it will be found that the point of fusion is still lower.

The spar should be as free as possible from iron-bearing or other dark-burning minerals. "Several dark-burning minerals—hornblende, tourmaline and black mica—if not completely separated, show in the fired sample or finished ware as very fine black specks. These would hardly be noticed by the uninitiated, but contribute a grey cast to the ware." Though quartz is added to the feldspar in the various mixtures, some users specify against free silica in excess of 5 per cent. They prefer to add the quartz themselves, thus obviating the danger of irregular results arising through the fluctuation of silica contents of the high-silica spar.

Feldspar, usually No. 2 grade, is used in enameling brick and metal. The spar is one of the fluxing materials which goes to form the porcelain-like coating of the ware. For this purpose, also, the spar should be as free as possible from the dark-burning minerals.

In the making of artificial teeth only the highest grade of feldspar, containing no dark-burning minerals whatever, is used.

In the manufacturing of abrasive wheels feldspar is one of the bonding materials used. On firing the wheels, the feldspar fuses and firmly cements the grains of emery, corundum or carborundum together. For this purpose No. 3 grade is employed, and, since the color is not of importance, small quantities of foreign minerals are not objected to.

The addition of alumina to the mixture for glass-making causes opalescence. Since feldspar contains alumina in a readily fusible form it is used in manufacturing opal glass. White mica in very small quantities, and free silica are permissible, but the spar should be as free as possible from iron-bearing or other minerals which would tend to color the finished product.

Very finely ground feldspar is used in preparing certain scouring soaps and polishes.

Coarsely granular feldspar of low grade is used as a surfacer for some prepared roofings.

In making artificial stone the surface to be exposed to view is made of a mixture of some fine grained mineral and cement. In some cases feldspar is the mineral used. Generally the white spar is specified, but the red is employed to produce certain effects. For this purpose the mineral is ground to pass a twenty mesh screen. The presence of small quantities of dark-colored minerals makes little difference, but such minerals as pyrite, which on weathering would cause stains, are decidedly objectionable.

A small quantity of low grade feldspar, crushed to about one-eighth of on inch, is sold as "poultry grit."

Fluorite or Fluorspar—The main use of fluorite is as a flux in the metallurgical industries. In the manufacture of basic open-hearth steel, large quantities are used to render the high calcium slag employed more fluid. No. 3 grade, containing 85 per cent. or more, calcium fluoride and about 3 per cent, or less silica, is specified. In some cases fluorite is used as a flux in blast furnace and foundry practice. For these purposes the cheapest grades are used.

Fluorite enters into the composition of the mixture used in enameling iron and steel ware. It is used also in the making of opal glass. "No. 1 ground," containing less than a half per cent. of oxide of iron is specified. Small quantities are used in etching glass.

In the chemical industry, fluorite is employed as a source of fluorine in the manufacture of hydrofluoric acid and various fluorides. For chemical purposes the higher grades are used exclusively.

Fluorspar is employed in the electrolytic refining of lead to prepare the lead fluosilicate used as electrolyte and also in the electro reduction of aluminum.

(To be Continued.)

COAL WASTE IN CANADA AND THE COMMISSION OF CONSERVATION

By F. W. Gray.

Dr. F. D. Adams, of McGill University, addressed the Commission of Conservation at its annual meeting in Ottawa during January on "Our Mineral Resources and the Problem of Their Proper Conservation," and further addressed the Canadian Mining Institute at the annual meeting in Toronto on the same fruitful subject.

Dr. Adams' paper has been given wide publicity, and very properly so, as it is one to arrest the attention of all thinking men, and is particularly interesting to coal men, because it deals in a comprehensive and yet concise manner with the wastage of coal in Canada, both with regard to the waste in the process of extraction and in connection with the utilization of coal as a fuel and a source of light and power. Further than this the utilization of coal in Canada can hardly be said to have advanced, except in one or two instances.

The subject is an apposite one at the present time, when the stoppage of German imports has shown the world how largely it had become dependent on the by-products of coal distillation as perfected in German laboratories and factories. No one who has ever given even the most cursory attention to the matter will dispute with Dr. Adams the neglected opportunities presented by the methods of using coal which are usual in Canada and the United States to-day. The refinements of coal distillation have indeed been up to now so neglected on this side of the Atlantic as to be almost non-existent, as witness the numerous recent announcements regarding the erection of benzol recovery plants in connection with by-product coke oven plants in the United States and in Canada. For almost twenty years past it has been the practice in European by-product coke oven plants to recover benzol along with the other by-products, but it is doubtful if there is one benzol recovery plant in Canada to-day, and even in the United States, with its astonishing annual coal output, the number of benzol plants is strictly limited. In this connection it will be interesting to see whether the Rittman process of recovering benzol and toluol from the residuals of crude petroleum is likely to become a serious competitor of the coke-oven benzol.

The "fuel engineer."—There is no more promising field of endeavor open to the young scientist of to-day than that of the "fuel engineer," that is to say, the man who combines with a working knowledge of mechanics and engine design a knowledge also of the proved possibilities of coal, of the conservation of the gases of combustion, and the complete utilization of all that is in the coal. The day is rapidly coming when the designer of a power plant will consider equally with the boilers and generators the by-product recovery plant that will be installed alongside to profitably utilize the gases and smoke which to-day are worse than wasted and pollute the atmosphere. There are already in existence power plants in which the production of power is really subsidiary to the profits obtained from the by-products of the fuel consumed in raising the power, so that, paradoxical as it may seem, the "by-product" has become the preponderating factor. The so-called "chemical engineer" or "fuel engineer" is a sign of the times, and a sign moreover of much promise. Apart from the question of the recovery of by-products is the problem of the complete utilization of heat, and the interesting line of research opened up by Dr. Bone, and carried into practical effectiveness by the Bonecourt boiler, recently put into operation in Great Britain.

Wasteful methods of extraction of coal.—But while everybody will heartily agree with Dr. Adams, and will welcome his courageous utterances in regard to the haphazard and wasteful methods attending the present use of coal, some of the strictures passed upon the methods of extraction seem to be unnecessarily severe.

Several wasteful methods in the extraction of coal are specified summarily as follows:

"Thick coal seams, capable of being easily and profitably worked, are mined without reference to the extraction of overlying or closely adjacent seams. Thick seams are only partially worked, the unworked portion being rendered irrecoverable. Pillars left to support the roof are not extracted as completely as they might be. Excessive use of powder causes too great a percentage of slack."

Nova Scotia methods.—A very serious statement is that: "In the coalfields of Nova Scotia the amount of coal which has been wasted is at least as great as that which has been extracted. This is apart from and in addition to the coal necessarily left in the mines under the methods of mining employed."

The writer is not fully acquainted with the conditions that exist on the mainland of Nova Scotia, but so far as the Island of Cape Breton is concerned, the foregoing statement seems to require some little qualification.

In the first years of mining in Cape Breton the thicker and more profitable seams were naturally first attacked, and because of the operation of the coal areas by independent and rival companies, the workings were not prosecuted so economically, nor with such efficiency as they might have been had the mines been laid out and conceived in relation to the coal deposit as a whole. This statement does not reflect on the engineering or management of the former proprietors of the mines, but is a necessary corollary of a number of rival operators mining areas of coal the boundaries of which were decided by arbitrary lease lines having no relation to the physical characteristics of the coal deposit considered merely as such. The pillars left for support of the roof were in many cases too small, and the coal was extracted out to the actual outcrop. The result has been that the operators of the present day have received a legacy of pumping which might have been avoided had the outcrop been maintained intact, and areas of pillars have been lost by "creep." This condition of affairs affects however but a negligible portion of the original areas, and is partly excused by the necessary experimentation which must take place before the local peculiarities of any coal field can be accurately determined. How little the actual loss amounts to may be gauged from the fact that the thick seams first worked in the Sydney coal field are still the seams from which the major portion of the output is being produced, and

from the conservation point of view it is fortunate that the preponderating portion of the coal areas of Cape Breton are now controlled by strong companies to whose vital interest it is to work the coal areas scientifically and with a due regard to the future.

Government supervision.—Dr. Adams hints that the improvement in methods of working coal in Nova Scotia is due to more effective Government supervision, and states:

"At the present time every mining company operating under lease from the Government of Nova Scotia is required to submit in advance the plans which it is proposed to follow in opening up any coal seam. These plans must be approved by the Chief Inspector of Mines, under whose supervision the actual mining of the coal is also carried out. The waste of coal has thus been greatly diminished; and would be reduced still further, were it not that in many cases it is now very difficult to introduce the best methods of extraction, owing to the condition in which the mines have been left by the early operators."

There is a misapprehension here, as the Government of Nova Scotia only requires advance plans to be submitted for approval in the case of submarine coal areas. Advance plans are not required in the case of land areas.

Mining coal in Pictou field.—There is justice in the contention that waste of coal areas has taken place, if reference is made to the thick beds of the Pictou field, and this was pointed out many years ago by Mr. H. S. Poole. It would be difficult to state, however, how much of this waste was due to difficult conditions of mining, occasioned by very thick coal seams, pitching at angles approaching the vertical, and associated with emissions of gas almost unprecedented. Mine fires have been largely responsible for the troubles which have affected the mainland fields. In this coal field, as in the Cape Breton field, the improvement to be anticipated, and even now taking place, will come from financially strong companies able to call to their aid the latest methods and the advice of the most competent men. In some of the coal areas of the Pictou field the wonder is not that so much should have been lost, but that any coal should ever have been won, considering the extraordinary physical difficulties that the small individual coal operator has had to face.

Regarding the working of coal seams so as not to endanger the workability of other seams overlying or underlying, this is a matter which has been very carefully considered in Cape Breton. The choice of the seams which have so far been worked has been determined by their accessibility, by the demand for coal of a particular quality, and other economic factors, but in no case have the unworked seams been endangered. There are in Cape Breton untouched to-day coal seams which will remain unworked for many years to come, because these seams are too thin, or of too poor a quality, to be economically worked at the present time. Some day these seams will be worked, but there is no reason to suppose that the working of the thicker seams at the present time will prevent the extraction of the thinner seams at a future date.

The excessive use of powder in blasting down the coal has undoubtedly been the cause of much waste on this side of the water, but this fact has been much more in evidence in the United States than in Canada, unless it is a feature of mining in the Canadian West. The pernicious practice of blasting "out of the solid," and paying for coal on a screened coal basis—leaving the slack in the mine—persists to this day in many parts of the United States, but so far as Nova Scotia is concerned both these practices are non-existent. Seeing that slack coal brings a much lower price in the market than round coal, it is evident that no person has a greater interest in the lessening of the slack percentage than the operator himself. The miner and his loader in Nova Scotia are paid on a run of mine basis, and from the point of remuneration for the work performed it is immaterial to these men whether they make much slack in the process or little. In at least one of the large Nova Scotian collieries no explosives of any kind are used in the extraction of the coal, and in other collieries the system of extraction has been largely decided by the desire to keep down the slack percentage as low as possible. The coal operator in the matter of the choice of an explosive is between two stools. The safer non-flaming explosives have all a tendency to shatter the coal, whereas the formerly used loose black powder worked more slowly and with less shattering of the coal. Apparently safety against flaming is associated with quickness of action, and slowness of action in an explosive spells danger from flame. Until the powder manufacturer can do better, it is to be expected that safety against explosion will be given precedence.

It may be mentioned that from the conservation point of view, the percentage of slack coal is not important, because in these days of slack and dust-fired boilers, slack coal is just as useful as round. The days when slack coal was left in the mine, or used to ballast railroad tracks, have long since past, and there is very little in the way of carbonaceous material around a modern colliery that does not go to the colliery boilers. In fact many of the old slack dumps left by former operators have been cleaned up for use under colliery boilers.

The longwall extraction method, as pointed out by Dr. Adams, permits of a very complete extraction of the coal in the first operation, and the system has for some time been used in Nova Scotia, both in Cape Breton and on the mainland. This method, moreover, by utilizing the roof pressure to break down the coal, avoids largely the use of explosives and produces much stronger and larger coal. The system cannot be successfully used in all cases, more particularly in thick clean seams without partings, and where packing material is scarce. A properly laid out mine on the pillar and room system can moreover be worked so as to secure a very complete extraction of the coal, and in many mines of this character the pillar drawing follows so rapidly upon the room-work that no crushing of pillars takes place. At one time room-work was given first consideration and the extraction of the pillars was a secondary consideration which was left to worry posterity, but to-day the manager of a colliery knows he is expected not only to extract the room coal, but to draw the pillars also.

The assumption that the improved methods of mining coal followed in Nova Scotia at the present time are due to Government supervision is rather flattering to the Nova Scotia Department of Mines. This department has always been noted for the technical excellence of the men that had been at the head of the mining affairs of the Province, and it is no exaggeration to say that the mining practice and the mining laws of Nova Scotia have always kept pace with those of other countries, and have been decidedly in advance of many countries, but the modern mining practice of Nova Scotia is largely an instance of the survival of the fittest and the adaptation of efficient corporate organization to the mining problem.

A recapitulation of the existing plants in Nova Scotia will reveal that these include the latest type of coal washer, dust-fired boilers, exhaust steam turbines, electrically driven air compressors, electric coal hoists, by-product coke ovens recovering tar, pitch and sulphate of ammonia, creosoting plants, tar refining works, making non-corrosive paints, disinfectants, etc., a slag fertilizer works; slag brick works and other modern plant which would take too long to detail, but sufficient has been written to indicate the advances which have been made in the coal mining industry of the Province and its off-shoots. It is not Government supervision, but corporate energy that has developed this modern practice, and has brought about a conservation of money and material of the most striking character.

Supervision of coal mines in Canadian West.—With reference to what appears to be the main contention urged by Dr. Adams, namely, that the dearly bought experience of coal mining in Nova Scotia should be applied to the beginnings of the coal industry in the Canadian West, there can be but little doubt as to the wisdom of this contention, and Dr. Adams' suggestion of a Chief Mine Inspector to supervise the coal areas owned by the Dominion in the West is a good suggestion. Such a man would need to be, as Dr. Adams says, a man of undoubted capacity and integrity, and with wide experience in the mining of coal. The best man obtainable would be none too good for so responsible a position, and he would indeed have to be a very big man to measure up to his job.

PLACER MINING IN THE ATLIN COUNTRY, BRITISH COLUMBIA

Under the above caption, the Alaska and Northwest Mining Journal, published at Seattle, Washington, printed in its February number the following particulars of mining in the most productive placer-gold field in British Columbia:

Many mining men, particularly those interested in Alaska, are often heard to inquire as to the mining activities in the Atlin country, and they wonder what is doing in that section since the stampede there, shortly after the Dawson excitement. The Atlin country is contiguous to the Alaska mineral belt, and on the generally traveled route to the interior of Alaska and the Yukon Territory by the way of Skagway and the White Pass Railway. A chain of lakes from Atlin to Caribou Crossing (Carcross) on the White Pass and Yukon route, which lakes are navigable with the exception of one portage of a distance of two or three miles, makes the trip into this country an easy, as well as a most picturesque and beautiful one.

According to many old prospectors who have been pretty well over the Atlin country, gold will be discovered for many years to come, as it has never been thoroughly prospected, owing largely to the fact that the Klondyke and many parts of Alaska, which proved much richer, lured the prospectors and investors to more promising fields, the Atlin stampede having lasted but a short time. However, in addition to a number of small hydraulic plants and minor activities on the different creeks throughout the district, one of the largest, if not the largest, hydraulic plant in the North or West, is continuously operated each season within a few miles of the town of Atlin.

Mr. Frank Mickle, who recently arrived in Seattle on his way to spend the winter in California, came directly from the Atlin district, and he states that there is considerable prospect work being done in the neighborhood of the new diggings on O'Donnell river, discovered about two years ago, some 25 miles from Atlin. Tunnel prospecting is still being prosecuted on the different creeks in the vicinity of Discovery. Bedrock in many places is too deep for the dredge, and in sinking or tunneling many good prospects have to be abandoned on account of too much water, which cannot be handled without the installation of an expensive pumping plant. Shafts have been sunk to a depth of 100 ft. on O'Donnell river, but the best prospects found so far are on the benches.

Mining men who have seen the North Columbia Gold Mining Co.'s hydraulic plant always speak of it as "big." Its water supply is obtained from Lake Surprise a body of water about 18 miles long by one wide. The company first constructed a large dam at the outlet of the lake, thereby raising the water in the lake 4 ft. and giving more than 150 ft. head with an unlimited supply of water. A huge ditch, six miles long and averaging 6 ft. in depth and 18 ft. in width, was constructed, a steam shovel having been used in this work. Three lines of 30 in. hydraulic iron pipe, tapering to 16 in., lead from the pressure box or penstock, a distance of about one-half mile to the giants. On the sluicing ground there are operated 12 to 15 giants, these ranging in size from four to seven inch nozzles, most of them of the latter size. Deflectors are used on all these giants, the tailing being stacked by the giants instead of by tailing stackers, which were tried without success on Pine creek, but abandoned as useless on ground of that character. The flume constituting the sluice boxes is four feet in width and has rail steel and heavy block riffles.

REGULATIONS GOVERNING STAKING OF "BAR-DIGGINGS" ON THE NORTH SASKATCHEWAN

Under date of January 26, 1915, the Dominion Government announced regulations governing the working of placer claims. The Privy Council report is as follows:

"Whereas the regulations governing placer mining in Manitoba, Saskatchewan, Alberta and the North-West Territories, established by Order-in-Council, dated the 8th of February, 1909, provide for the granting of entries for creek, river and inland placer mining claims, having in each case a frontage of 500 feet by a breadth of from 1,000 to 2,000 feet.

"And whereas a number of applications have been made for permission to operate, by means of 'rocker' and 'grizzly,' the bars in the North Saskatchewan River in the vicinity of Edmonton, which are known to contain gold in sufficient quantity to make the operation thereof fairly remunerative.

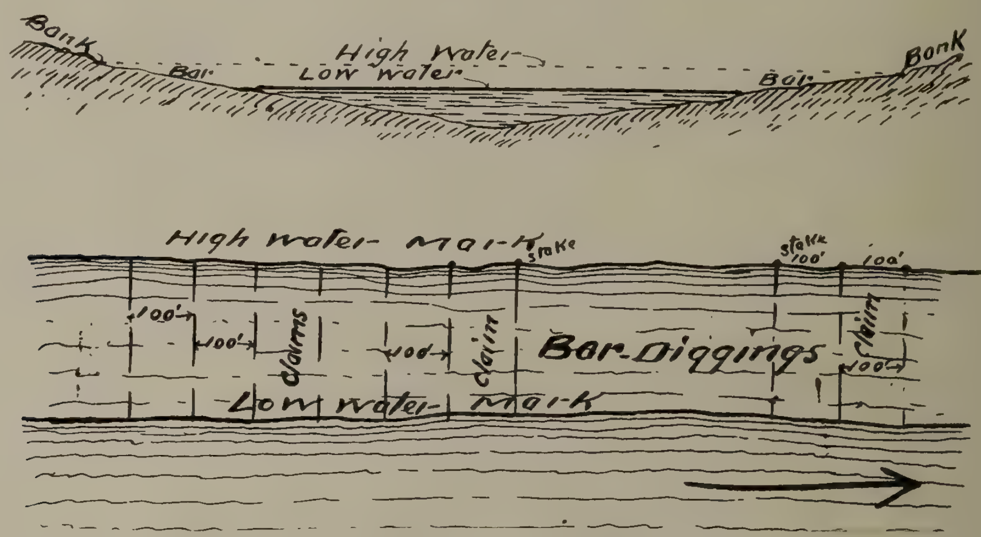
"Therefore the Governor-General-in-Council, in view of the demand which would appear to exist in the Edmonton mining district for small areas of placer mining ground to be operated by hand-methods, is pleased to authorize and doth hereby authorize the Minister of the Interior to grant applicants permission to acquire such ground on the North Saskatchewan river under the following conditions:

"(1) 'Bar-diggings' shall comprise lands in and along any river over which the water extends during the high-water, but which are not covered at low water.

"(2) 'Bar-diggings' shall comprise a strip of land 100 feet wide along the high-water mark of any river, thence extending into the river to its lowest water level.

"(3) Any person desiring to work bar-diggings, the property of the Crown, may upon payment of a fee of $1 to the Mining Recorder for the district in which the rights applied for lie, obtain a certificate upon the following form. This certificate will entitle the holder thereof to stake out, in accordance with the provisions of the regulations governing placer mining in Manitoba, Saskatchewan, Alberta and the North-West Territories, and work bar-diggings of the dimensions above prescribed.

"(4) The holder of a certificate who has staked out available ground in the manner above described, may continue to hold the same as long as he continues to operate it to the satisfaction of the Mining Recorder for the district in which the rights lie, but in case a claim staked out under these regulations remains unworked for three consecutive working days, the rights acquired under such staking shall absolutely lapse, unless a lay-over has been granted by the Mining Recorder.



Plan and Section of Bar-Diggings on North Saskatchewan

"(5) The holder of a certificate shall not, in the exercise of the rights acquired under such certificate, cause any damage to or interfere in any way with any roads, ways, bridges, drains or other public works or improvements, and the certificate shall be subject to immediate cancellation at any time without compensation to the holder thereof for any breach of any of the above conditions, or in case it should be shown to the satisfaction of the Minister of the Interior that the operations under the certificate are likely to cause damage, or otherwise prejudicially affect the interests of the Crown or others.

"(6) The operation of bar-diggings shall at all times be under the direct supervision of the Mining Recorder for the district in which the rights applied for lie, and to his satisfaction.

Certificate.

"This is to certify that
of has paid me this day the sum of $1.00, and is therefore entitled to all the rights and privileges prescribed by Order-in-Council governing the granting of 'bar-diggings' on the North Saskatchewan river."

TORONTO BRANCH, C.M.I.

At a meeting of the Toronto branch of the Canadian Mining Institute, held on Feb. 27, the following resolutions were carried unanimously:

Moved by J. Murray Clark, K.C., seconded by J. B. Tyrrell, F.G.S., that the Toronto branch of the Canadian Mining Institute desires to congratulate most heartily their fellow-member, Willet G. Miller, Ph.D., LL.D., upon being awarded the gold medal of the Institution of Mining and Metallurgy. The Toronto branch appreciates the great distinction thus conferred, as the Institution of Mining and Metallurgy is the most important organization connected with mining in Great Britain, and perhaps in the world, and recalls that the gold medal of this distinguished Institution is only given on very special occasions and in recognition of great merit and signal achievements. The Toronto Branch further desires to place on record their view that in this case the award was well merited by Prof. Miller on account of his high scientific attainments and achievements and his great services to the Canadian Mining Institute and the mining industry of Ontario.

Moved by J. Murray Clark, K.C., seconded by J. B. Tyrrell, F.G.S., that the hearty congratulations of the Toronto Branch of the Canadian Mining Institute be hereby tendered to Professor A. P. Coleman, Ph.D., F.R.S., upon his election as president of the Geological Society of America. The Institute appreciates the great distinction conferred on one of their members, and believes that Professor Coleman will fulfil the duties of this high office with great advantage to the Geological Society, with credit to himself and the University of Toronto and with honor to Canada.

OVERCUTTING COAL.

The Jefferson Mfg. Co. has recently issued Bulletin No. 129-A, illustrating and describing Jeffrey "Arcwall" coal cutters for "overcutting" system of mining.

This bulletin contains valuable information about the design and construction of the "Arcwall" type of mining machine, which is built to cut anywhere above the top of the rail, and is especially adapted for cutting out dirt binders that exist in the coal seam. It also contains interesting views of some of the latest installations. Copies may be obtained by writing to the Jeffrey Manufacturing Company, Montreal, Can.

PERSONAL AND GENERAL

Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., operating the Jewel gold mine and stamp mill near Greenwood, Boundary district, B.C., has been examining mining property in North Saskatchewan.

Mr. M. S. Davys, managing director of the Silverton Mines, Limited, which owns the Hewitt-Lorna Doone group of mines, and a concentrating mill in Four-mile camp, near Silverton, Slocan Lake, B.C., has been on a visit to Victoria.

Mr. George H. Dickson, a Kingston School of Mines man, after having been for some years engaged in mining in Alberta and British Columbia, has volunteered for active service in connection with the war in Europe.

Mr. Robert G. Drinnan, who for fifteen years or more has been closely associated with the management of coal mines in the Crowsnest district of British Columbia and others in Alberta, has been appointed general manager for the Hillcrest Collieries, Ltd., with coal mines in the Blairmore-Frank district, southwest Alberta.

Mr. S. Duncan Ellis, a Toronto University mining engineering student prior to joining the Braden Copper Co.'s staff in Chile, has arrived in England with a number of others from South America who have volunteered for army service. He was at the Falkland Islands shortly after the destruction of the German war vessels in those waters, and sent home to Victoria, B.C., some interesting particulars of that memorable sea fight.

Mr. W. J. Elmendorf, for several years general manager for the Portland Canal Tunnels, Ltd., of Victoria, B.C., was recently in Denver, Colorado. Shortly after his return to his present headquarters in Seattle, Washington, he left for Alaska, on an extended trip through the Fairbanks and other interior districts of that country.

Mr. George Watkin Evans, of Seattle, for some time engaged in examining coal areas in the Groundhog basin of northern Skeena, B.C., and later in charge of operations in getting out 800 tons of coal from the Matanuska field, Alaska, for U. S. navy tests, was among visitors to Victoria, B.C., to attend a recently held meeting of the Western Branch of the Canadian Mining Institute.

Mr. Percy F. Horton, manager of the Zincton and other lead-zinc properties in the neighborhood of Salmo, Nelson mining division, British Columbia, has been spending a week or two on the coast, having been called to Victoria after the death of Mr. H. M. Billings, one of the chief owners of the properties mentioned.

Mr. Frederic Keffer has removed from Greenwood, Boundary district, B.C., to Spokane, Washington, after having been continuously engaged in mining in that district ever since he went there in the summer of 1896.

Mr. Guy H. Kirkpatrick, a Kingston School of Mines graduate who, after some years in Africa, has been associated as a mining engineer with Capt. J. E. Leckie and Lieut.-Col. R. G. E. Leckie at Vancouver, B.C., is now officer commanding the 11th Canadian Mounted Rifles, organized in British Columbia and awaiting a call to active service.

Mr. Lewis A. Levensaler, of the Tacoma Smelting Co., Tacoma, Washington, was in Kootenay district of British Columbia a short time ago, and afterward on a business visit to Victoria.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., left Greenwood, Boundary district, B.C., in the early part of March for New Cork City, to attend the annual meeting of the company called for March 9 last, but postponed until later in the month.

Mr. F. Chas. Merry, formerly superintendent for the Ferguson Mines, Ltd., with silver-lead mines in Lardeau district of British Columbia, has gone to Utah after a short stay at Kaslo, B.C.

Mr. L. Muller, superintendent of the John Hopp placer-gold mines near Barkerville, Cariboo district, B.C., has gone to New York to join Mr. Hopp, who has been in the East several weeks on business connected with a proposed new mining development in Cariboo district.

Mr. Ed. G. Montgomery, assistant superintendent of the Consolidated Mining and Smelting Co.'s Centre Star group of mines in Rossland camp, British Columbia, recently made a hasty trip to Moose Jaw, Saskatchewan, and return.

Mr. F. M. Sylvester, general manager for the Granby Consolidated Co., and Mr. Wakely A. Williams, the company's smeltery superintendent, have returned to British Columbia from a business visit to New York City.

Mr. Robert C. Sticht, general manager for the Mt. Lyell Mining and Railway Co., who several months ago returned to Tasmania after having spent a long vacation in the United States, has been elected president of the Australasian Institute of Mining Engineers.

A press despatch from Fernie, Crowsnest district of British Columbia, states that news has been received at Fernie that Harry Miard, late pit boss at the Crow's Nest Pass Coal Co.'s No. 3 mine at its Coal Creek colliery, now serving with the French army, and who was wounded in an engagement in the neighborhood of Soissons, France, is rapidly recovering from his wound. It is believed that Mr. H. E. Miard, a member of the Canadian Mining Institute, is the man referred to in the despatch.

Prof. H. T. Kalmus, Queen's University, has resigned.

Mr. J. M. Clark, of Toronto, has been requested by the American Institute of Mining Engineers, to again act on its committee on mining law.

Mr. G. G. S. Lindsey returned to Toronto from England, March 19, and left the following week for China, where he expects to be for some months.

Mr. S. W. Cohen is in Nicaragua superintending investigation of the Bonanza gold mine, which is under option to the Crown Reserve mining company.

Lieut. B. A. C. Craig attended the meeting of the Toronto branch of the Canadian Mining Institute on Monday, March 22. He leaves shortly for France.

Mr. Wm. McGinnis, of Calgary, is in Toronto.

Capt. De Lamar has been elected president of Dome Mines, Ltd.

OBITUARY

The Vancouver Daily Province recently published the following news: George Mitchell, who in the early Klondike days made quite a fortune in promoting the White Pass Railway, died recently at Harrison Hot Springs, aged sixty-five. He was a great friend of Sir Wilfrid Laurier and lived in Ottawa much during recent years. Last year he had financed a railway project to build from Taku to Atlin, but the coming of the war caused his arrangements to fall through.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND SWASTIKA

More properties to be worked.—When the power situation is relieved the success of the present operating companies will undoubtedly stimulate other companies holding prospects to commence work. It is currently reported in the camp that work will be started in May on the Krist claim. This property adjoins the Porcupine Crown on the south. It was bought by an English syndicate some years ago and immediately after it was purchased some buildings were run up and a shaft put down on a wide quartz vein with very low gold assays. Nothing has been done for years. Now it is understood that operations are to be resumed when power can be obtained. There is no steam plant on the property.

The South Thompson adjoins the North Thompson which the Huronian Belt Co. is working. The Huronian Belt found some very good ore near the line between the two properties and there is no doubt that the property has good prospects.

Dome.—It is understood that the Dome will draw ore from the shaft on the Golden Stairways vein to the rock house on the surface. A system of electric locomotives for hauling ore cars over the surface is being considered. The shortage in power continues to hinder production and raise costs. The Dome mining company is now working on its own power, using the very complete steam plant that was installed before the Waiwaiten Falls power was finished. At the Hollinger the auxiliary steam plant is being run also.

Schumacher—Good progress is being made with the plans for the Schumacher mill and it is confidently believed that it will be running early in the spring.

Acme.—The Acme section of the Hollinger mill is now running and ore from the stopes on that property is being pulled for treatment every day. This will add largely to the production from the camp, as previously only a few tons of ore per month could be treated in the Hollinger mill. In the meanwhile the addition to the Hollinger mill proper is being proceeded with.

Deloro.—It is stated that the Pike Lake Gold Mining Company of Swastika have purchased some claims in Deloro township about three miles south of South Porcupine. Mr. Reeves states that both these claims and also the properties of the company at Swastika, which adjoin the old Swastika mining company, will be worked.

Dome Lake.—By the re-arrangements of the crushing plant and the installation of more tables it is planned to raise the capacity of the Dome Lake mill from 50 to 75 or 80 tons a day. The returns from the mill are now about paying operating expenses but owing to the heavy charge for development the mining costs are high.

Mining men to the front.—Both from Cobalt and Porcupine members of the staffs of many mines are still going out to join the contingents of Canadians preparing for the front. Most of these men have obtained commissions, others have been able to obtain appointments as non coms. The percentage of mining men in the fighting ranks is increasing every day. Mr. R. P. Rogers, manager of the Coniagas mine for many years, and one of the best known mining men in the north has obtained a commission as adjutant in the 97th Regiment and will go to the front. Mr. Rogers is a graduate of the Royal Military College at Kingston. Every day the train from the north carries some young member of a mining staff down to the south to the training camps.

Hollinger.—Hollinger has commenced to sink a winze on the main vein from the 850 level, where 200 ft. of ore has been opened up already, to the 925 ft. The main Hollinger shaft will be carried down to the 800 ft. level, while the new central shaft has passed the 400 ft. level.

At the Acme ore is now being run to the mill from the 675 ft. level. The shaft will be carried straight down to the 800 ft. level, from which depth a crosscut will be run to the main workings of the Hollinger itself.

McIntyre.—The great width of the No. 5 vein on the McIntyre is being well maintained. At the 400 ft. level of the shaft on the other side of the lake it is established that there is a good grade of ore for a width of 19 ft. This is by no means the average as far as can be ascertained, but at all points the ore can be stoped for more than 6 ft.

Dome.—The Dome mill run for the month of February shows that the grade put through the mill was higher than for several previous months. The tonnage treated was slightly higher and the increase was reflected in the bullion produced. The record for the month of February, although the month was shorter, was: Ore milled, 21,600 tons; value per ton, $3.91; gold recovered, $84,412.

COBALT, GOWGANDA AND SOUTH LORRAINE

Temiskaming.—Development on the extension of the ore shoot found on the top of the old Titanic stope at the Temiskaming still continues to show excellent results. It appears that the vein had been followed by the old management, but that it had been lean, and that after following it for some time work was abandoned on it for the time being. Recently seeing that the vein looked healthy the superintendent put a few shots into the calcite, with the result that there is now bonanza ore in the face. The vein, which was first found and worked on the Beaver and has been followed over the boundary, and is now being worked on the Temiskaming is now being developed on three levels of the Temiskaming mine. All faces are in good ore.

The Peterson Lake Mining Co. is now connected up along almost the entire length of the west shore of Peterson Lake. Long crosscuts connect the No. 1 shaft at the narrows with the old Kerry shaft, and the old Kerry is linked up with the No. 3 shaft, which was once the Little Nipissing. Three drills are running now; but two more will be put on shortly. One drill is sinking a winze on the vein which yielded good ore last year, and another is drifting on the extension of the "J" vein of the Nipissing. This vein is strong and carries a good deal of niccolite and some smaltite, but there are practically no silver values. Two drills will be put on soon, one at the Narrows and the other to crosscut for the extension of the Nipissing vein, from which high grade ore was mined in the earlier days of the camp.

The Miller-Lake O'Brien, the only property working in the Montreal River section, shipped a car of ore to the smelters last month.

Cobalt Lake.—Preparations for the draining of Cobalt Lake are now complete, and pumping will commence immediately the ice is off the lake. Next week the mill will close down and will remain closed down for three weeks owing to the shortage of power. Underground there is some improvement.

The sudden rise in silver to the relatively satisfactory price of 50 cents is discounted to some extent by the heavy cost of insurance of silver bullion to London. Little bullion is leaving the camp in consequence.

The Meteor Mining Co., operating on the side of Diabase mountain nearest the Savage, is doing a large amount of development work. Parallel with the Savage line crosscuts are being run from the bottom of a winze 82 ft. below the 162 ft. level. It is hoped by these crosscuts to encounter the extensions of the Savage veins.

BRITISH COLUMBIA

As more returns of mineral production in the province in 1914 come in it is seen that the preliminary estimate published at the beginning of the year was well within the mark. The estimated total value given in the bulletin issued by the Provincial Department of Mines was $26,189,020; early in March the total had increased to about $26,450,000. The final figures can not yet be stated, but it seems probable that when all the revised returns shall have been received the total will be found to be not less than the higher of the two amounts given above.

East Kootenay.

The considerable increase in the output of ore from the Sullivan mine, situated near Marysville, in Fort Steele mining division, is indicated by the following comparative figures: During ten weeks ended March 11 of this year the total quantity of Sullivan ore received at Trail was 8,042 tons, an average of 804 tons a week; in the corresponding period of 1914 it was 3,431 tons, an average of 343 tons a week. For the whole of 1914 the total was 34,935 tons, an average of 672 tons a week. On the other hand, there was shipped from the St. Eugene mine, in the same division, during the first quarter of 1914, 246 tons, while this year not any ore has been produced at that mine.

West Kootenay.

Ainsworth.—Work has been resumed at the Consolidated Mining and Smelting Co.'s No. 1 mine, near Ainsworth, and the shipment of ore is once again in progress. During eight months of 1914, up to the time of suspension of work in August, 5,076 tons of ore was shipped to Trail, but not any since then until quite recently. The company also owns the Highland mine and concentrating mill, in the same camp, and it is expected these will be in operation again ere long. The Banker and Maestro, adjoining properties in another part of Ainsworth camp, were also worked last year, up to the end of the summer, by the Consolidated Co. No announcement has yet been made relative to the prospects for work being again undertaken on the last-mentioned two mines, but it is hoped their further development will be proceeded with shortly; more than 700 tons of silver-lead ore was shipped to Trail from them last year, and it is stated there is still ore available for extraction.

Slocan.—Gradually the 1915 list of Slocan mines shipping ore becomes longer. Following the outbreak of the war last year, there was nearly a general suspension of production, for of twenty properties from which more or less ore was shipped in 1914 only two or three made any output in September. Receipts of ore at the Trail smeltery during ten weeks of this year, to March 12, from Slocan mines totalled 798 tons, more than half of which was from the Rambler-Cariboo mine. Shippers of silver-lead ore or concentrates were as follows: Enterprise, 25 tons; Hewitt (Silverton Mines, Ltd.), 106 tons; Idaho-Alamo, 58 tons; Mercury, 17 tons; Rambler-Cariboo, 444 tons; Reco, 73 tons; Ruth, 48 tons; Slocan Star, 27 tons. In addition, zinc ore and concentrate was shipped; figures published by the Daily News, Nelson, follow: In January, Hewitt, 119 tons; Rambler-Cariboo, 83 tons; Surprise, 600 tons; total 807 tons. In February, Hewitt, 126 tons; Rambler-Cariboo, 84 tons; Surprise, 516 tons; total 726 tons. March figures are not yet available. Zinc ore was also shipped from two mines in Ainsworth division, namely, the Utica, 85 tons, and J. L. Retallack & Co.'s Whitewater group, 86 tons. Altogether the foregoing figures give a total of 1,704 tons, shipped to United States zinc reduction works.

While no particulars have been obtained, there does not seem to be any doubt that the Silverton Mines, Limited, has succeeded in overcoming the difficulties that attended its early efforts to save the silver-zinc content of ores from its Hewitt-Lorna Doone mine. Positive statements have been made to the effect that a saving of more than 9 per cent. of the metallic constituent of the ore is being made. The company has a concentrating mill on Four-mile creek, distant from the mine about a mile, means of transportation between mine and mill being by aerial tramway. The expectation of two or three weeks ago that the Standard Silver-Lead Mining Co., would without further delay again operate its concentrating mill to full capacity had not been realized by the middle of March, but the general manager and the head office manager were at the property about that time, so a decision as to the course to be taken in the early future may be looked for soon. Meanwhile some development work is being continued in the Standard mine, in which there are large reserves of ore available for extraction whenever market conditions for the disposal of silver, lead, and zinc shall be less unsatisfactory to the mine owner than in the recent past.

Nelson.—Production figures for mines in Nelson division for ten weeks to March 12 do not compare favorably with those for the corresponding period of 1914, so far as concerns mines that ship ore to the smeltery. The total for the first-mentioned period is but 1,143 tons, against 5,903 tons for the first ten weeks of 1914. The chief loss in quantity is attributable to the fact that the Silver King mine is inoperative, for last year its output for the ten weeks included in the comparison now made was 3,325 tons while this year no ore has been sent out from it. There has been a considerable decrease, as well, in the output of lead ore from mines near Salmo, the total for this year to March 12 having been only 820 tons as compared with 2,074 tons last year. Excepting that no ore has been received this year from the Yankee Girl mine, at Ymir, where development work only has been having attention, there has been an improvement as regards properties producing gold ore. For instance, gold concentrate was shipped from the Queen mine, Sheep Creek, this year to an extent three times larger than in the corresponding period of 1914. Then the Dundee, at Ymir, and the Granite, near Nelson, were small shippers this year, which was not the case last year, and several smaller producers are on this year's list as well.

MARKETS

TORONTO MARKETS.

Mar. 23—(Quotations from Canada Metal Co., Toronto).
- Spelter, 15 cents per lb.
- Lead, 5½ cents per lb.
- Tin, 60 cents per lb.
- Antimony, 25 cents per lb.
- Copper, casting, 17 cents per lb.
- Electrolytic, 17 cents per lb.
- Ingot brass, yellow, 10c.; red, 12 cents per lb.

Mar. 23—(Quotations from Elias Rogers Co., Toronto).
- Coal, anthracite, $8.00 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Mar. 19—Connellsville coke, (f.o.b. ovens).
- Furnace coke, prompt, $1.50 to $1.60 per ton.
- Foundry coke, prompt, $2.00 to $2.50 per ton.

Mar. 19—Tin, straits, 55.00 cents.
- Copper, Prime Lake, 15.00 cents.
- Electrolytic copper, 15.00 cents.
- Copper wire, 15.87½ cents.
- Lead, 4.10 to 4.15 cents.
- Spelter, 10.12½ cents.
- Sheet zinc, (f.o.b. smelter), 13.50 cents.
- Antimony, Cookson's, 29.00 cents.
- Aluminum, 18.75 cents.
- Nickel, 42.00 to 45.00 cents.
- Platinum, soft, $41.00 per ounce.
- Platinum, hard, 10 per cent., $44.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $60.00 to $65.00 per 75-lb. flask.

SILVER PRICES.

March—	New York cents.	London pence.
9	50	23 9/16
10	51	24 1/16
11	51½	24 5/16
12	51⅛	24 3/16
13	51⅛	24 3/16
15	51½	24¼
16	51⅛	24⅛
17	50¾	23 15/16
18	50⅛	23⅝
19	50⅜	23 13/16
20	50¼	23¾
22	50⅜	23 13/16

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.).

March 22, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	.34⅛	.34¼
British Copper	.00¾	.01
Braden Copper	.07¼	.07⅜
Chino Copper	.36½	.36¾
Giroux Copper	.00¼	.01
Green Can.	.27	.27½
Miami Copper	.23⅝	.24
Nevada Copper	.12½	.12⅞
Ohio Oil	134.00	136.00
Ray Cons. Copper	.18¾	.19
Standard Oil of N. Y.	218.00	219.00
Standard Oil of N. J.	393.00	395.00
Standard Oil (old)	1225.00	......
Standard Oil (subs)	840.00	......
Tonopah Mining	.07½	.07¾
Tonopah Belmont	.45	.45⅞
Tonopah Merger	.23	.25
Inspiration Copper	.22½	.22⅞
Goldfield Cons.	.00 11/16	.00¾
Yukon Gold	.02⅝	.02⅞

Porcupine Stocks.

	Bid.	Ask.
Apex.	.02	.02½
Dome Extension	.09	.09¼
Dome Lake	.26	.26½
Dome Mines	13.10	13.40
Foley O'Brien	.16	.18
Hollinger.	23.50	24.00
Jupiter.	.11	.11½
McIntyre.	.38½	.39
Pearl Lake	.02	.02½
Plenaurum.	...	.50
Porcupine Gold	.00¼	.00½
Imperial.	.02¼	.02½
Preston East Dome	.01¼	.02
Rea.	.12	.16
West Dome	.06	.11
Porcupine Crown	.80	.83
Porcupine Pet	.15	.20
Porcupine Vipond	.40	.42
Teck Hughes	.06	.06½

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.02¼	.03½
Beaver.	.30¼	.31
Buffalo.	.65	.95
Chambers Ferland	.13	.15½
Coniagas.	4.70	5.00
Crown Reserve	.80	.85
Foster.	.02	...
Gifford.	.01	.01¼
Gould.	.00⅜	.00½
Great Northern	.03	.03¼
Hargraves.	.01	.01½
Hudson Bay	...	24.00
Kerr Lake	4.70	4.90
La Rose	.65	.70
McKinley.	.40	.43
Nipissing.	6.05	6.15
Peterson Lake	.23½	.23¾
Right of Way	.02½	.03
Leaf.	...	.02½
Silver Queen	...	.02½
Temiskaming.	.24	.24½
Trethewey.	.16	.17
Wettlaufer.	.05	.05½
Seneca Superior	1.20	1.30

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer. Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwilliim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN—New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Summary Report of the Geological Survey for the year 1913.
NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
QUEBEC
Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.
ONTARIO
Museum Bulletin No. 5. A Beatricea-like Organism from the Middle Devonian, by Percy E. Raymond.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.
NORTH-WEST PROVINCES
Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.
Memoir 61. Moose Mountain District, Southern Alberta (Second Edition), by D. D. Cairnes.
BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.
Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.
YUKON AND NORTH-WEST TERRITORIES
Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.
NEW BRUNSWICK AND NOVA SCOTIA
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.
QUEBEC
Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.
NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
BRITISH COLUMBIA
Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.
1321. Diagram Showing the Geology of Texada Island, British Columbia.
Map 106A. Groundhog coal field, British Columbia. Geology.
YUKON AND NORTH-WEST TERRITORIES.
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.
Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

The Canadian Miner's Buying Directory.

Air Hoists—
Canadian Ingersoll-Rand Co., Ltd.

Amalgamators—
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.

Assayers' and Chemists Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Ball Mills—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Mussens, Ltd.

Beams—Steel—
Dominion Bridge Co.
Mussens, Ltd.

Belt Tighteners and Clamps—
Dodge Mfg. Co., Ltd.

Belting—Leather, Rubber and Cotton—
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

Blasting Batteries and Supplies—
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Blowers—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

Boots—
Dodge Mfg. Co., Ltd.

Buckets—
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

Chain Blocks—
Mussens, Ltd.

Chemists
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Mining Exposives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Collars—
Dodge Mfg. Co., Ltd.

Compressors—Air—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Concentrators and Jigs—
Fraser & Chalmers of Canada, Limited.
James Ore Concentrator Co.
Mussens, Ltd.

Concrete Mixers—
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Condensers—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Peacock Bros.
Northern Canada Supply Co.

Conveyors—Belt—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Converters—
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.

Conveyor—Trough—Belt—
Hendrick Mfg. Co.

Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.

Cranes—Electric—
Mussens, Ltd.

Cranes—Overhead Traveling—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Crane Ropes—
Mussens, Ltd.
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Lymans, Ltd.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamonds (for Diamond Drills)—
Abe. Levine.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith and Travers.

Dredging Machinery—
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.

Drills, Air and Hammer—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Mussens, Ltd.

Dump Cars
Sullivan Machinery Co.
Mussens, Ltd.

Drills—Electric—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.

Elevator Cups—
Dodge Mfg. Co., Ltd.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Oil—
Peacock Bros.
Boving & Co. of Canada, Ltd.

Engines—Crude Oil—
Boving & Co. of Canada, Ltd.

Engines—Steam—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Fans—Ventilating—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.

Fixtures—Counter Shaft—
Dodge Mfg. Co., Ltd.

Flights—
Hendrick Mfg. Co.

Floor Stands—
Dodge Mfg. Co., Ltd.

Friction Clutches—
Dodge Mfg. Co., Ltd.

Forges—
Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

Hoisting Engines—
Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

Hose—
Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
C. L. Constant Co.
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

ducer—Gas—
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Pulleys—Iron, Wood Spit, Iron Centre Wood Rim—
Dodge Mfg. Co., Ltd.

Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
Smart-Turner Machine Co.

Quarrying Machinery—
Mussens, Ltd.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Fraser & Chalmers of Canada, Limited

Rolls—Crushing—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Roofing—
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville

Rope Blocks—
Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

Screens—
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons.

Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Spiral Conveyors—
Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

Stacks—Smoke Stacks—
Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.

Stamp Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Steel Drills—
Sullivan Machinery Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley.
C. L. Berger.

Switchboards—
Northern Electric Co., Ltd.

Take-ups—
Dodge Mfg. Co., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co., Ltd.

Transformers—
Northern Electric Co., Ltd.
Peacock Bros.

Transits—
C. L. Berger & Sons.
Peacock Bros.

Transmission Rope—
Dodge Mfg. Co., Ltd.

Trippers—
Dodge Mfg. Co., Ltd.

Tube Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

Winding Engines—
Mussens, Ltd.
Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.

Wire Cloth—
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co., Ltd.

Wire (Bare and Insulated)—
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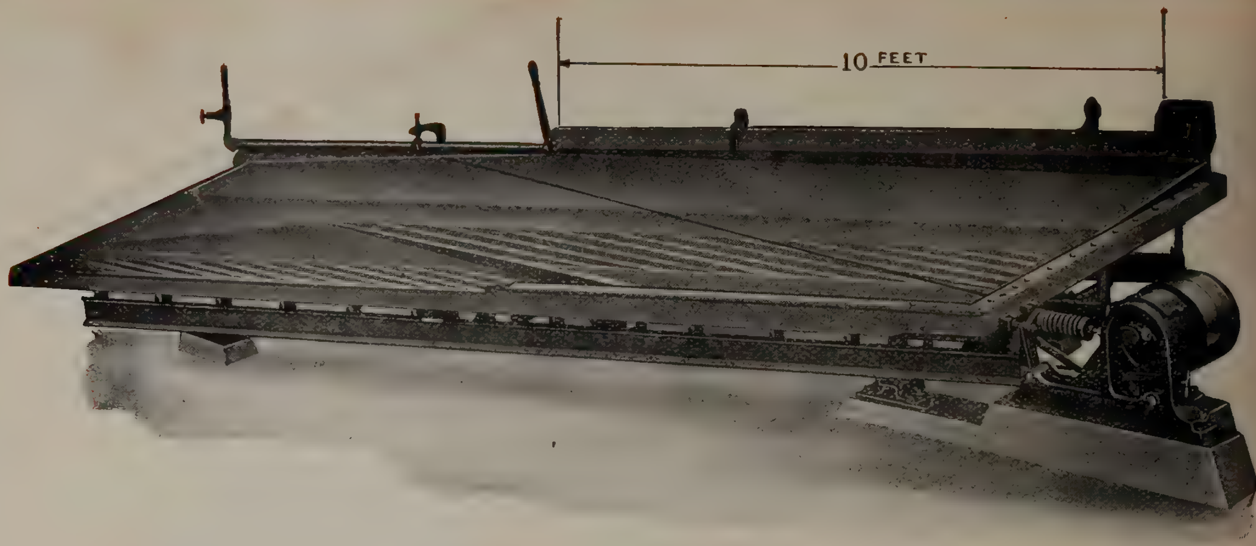
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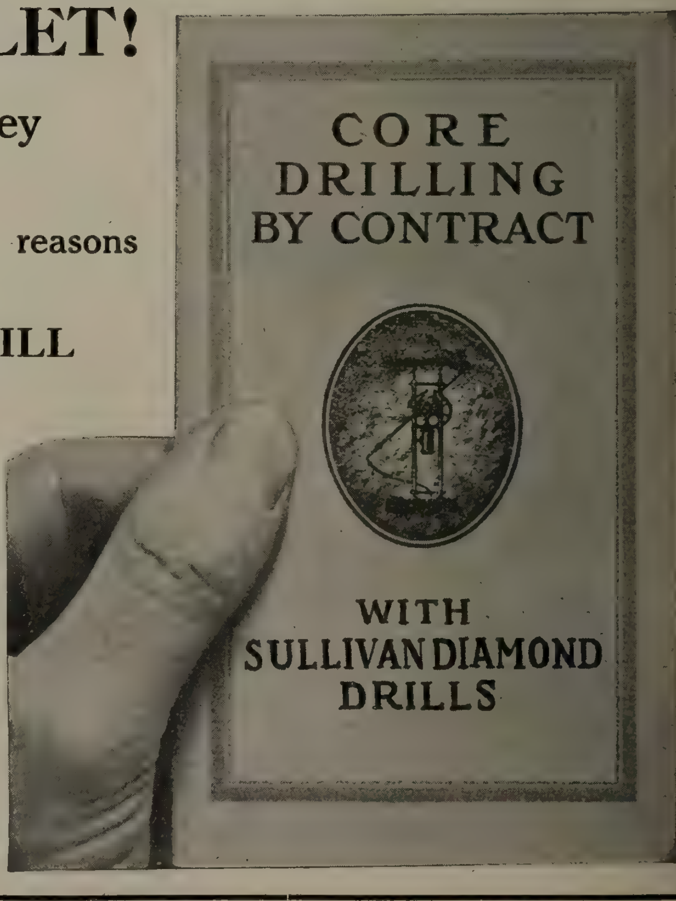

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CONTENTS.

COPPER PRODUCERS PROSPERING

A wonderful change for the better in the copper market has been experienced during the past few months. For a few weeks following the outbreak of war the outlook of the copper mining industry was dark indeed. Now the owners of copper mines find themselves in an enviable position with a very pleasing prospect.

The first notable action taken by American copper producers in August was to cut down output to about one-half. Several mines were closed down and others were operated part time only. There was still an excess of copper produced, however, as there was already many million pounds in process of treatment. The price fell to around 11 cents, and there was not a very ready market at that price.

With copper at 11 cents many well known mines cannot make a profit on operations. Consequently there were more mines closed down, though some companies continued to work their mines even at a loss.

It did not seem likely that the price would rise sharply for some time. Germany, the largest European consumer of American copper, was cut off entirely. Consumption by the Allies increased; but domestic consumption was small.

Then a flood of orders for copper began to be reported. The price rose sharply; but it was predicted that the rise was only temporary. Further large orders from abroad and from American consumers have convinced the producers that good prices are to be expected for some time. The stocks on hand are said to be low. The forces at the producing mines are being increased, and other mines are being reopened. A busy year in copper mining districts seems assured.

The Boston News Bureau, in a recent issue, says regarding the copper situation in the United States:

"Strangely enough, the very event which at first shocked the industrial world, including the copper industry, into insensibility is now producing a demand for copper the parallel of which has never been witnessed. For instance had the month of February been a 31-day month instead of a 28-day month, the deliveries of copper for that period to domestic manufacturers would have eclipsed all records, and the high record month to date is 84,000,000 pounds. During the 31 days of March, however, all records for domestic deliveries were broken, and the price of the metal has naturally responded to this heavy buying.

"What is distinctly encouraging is the improvement in the demand for copper wire. This end of the copper consuming industry has been lagging behind, but is now picking up in most encouraging fashion. Of course, the brass mills and ammunition people are working

night and day to keep up with the foreign war orders, and the copper price outlook is distinctly in favor of a higher rather than a lower level."

A notable feature of the copper market is the unusually high price being paid for the output of certain Michigan mines. While the price for ordinary copper is about 16 cents, these Michigan companies are receiving about 17 cents per pound for their copper. In Michigan the copper occurs as the native metal and it is easily refined to a product having exceptionally valuable physical properties.

On account of its freedom from impurities, and its special physical properties, Michigan, or "Lake" copper commands a higher price than "electrolytic" at all times. For use in munitions of war the Michigan brands are commanding a higher premium than usual.

THE DEMAND FOR MOLYBDENITE

We publish in this issue an article on molybdenum ores which has been prepared by the Imperial Institute, London. There is a great demand for molybdenum ores just now and owners of deposits of molybdenite will do well to seize the opportunity which now presents itself. The Imperial Institute will be glad to have the names and addresses of any firms in Canada producing this mineral and wishing to communicate with possible buyers in the United Kingdom.

Molybdenite occurs in many places in Canada, generally in quartz veins and pegmatite dikes. In a special report Dr. T. L. Walker mentions the following localities as among the most promising seen in 1910:

Island opposite Romaine, lower St. Lawrence; Aldfield and Egan townships, north of the Ottawa river; deposits in the vicinity of Kewagama lake in the northern part of Pontiac county, Que., near the Grand Trunk Pacific railway; Brougham, Lyndoch, and Ross townships in Renfrew county; Sheffield township, Addington county, and Cardiff township, Haliburton county, in Eastern Ontario; and the Giant mine, Rossland, B.C.

A weekly newspaper devoted to the interests of the mining industry of Northern Ontario made its first appearance on Saturday, March 27. Its eight pages are devoted chiefly to interesting and reliable news of the silver and gold mines at Cobalt and Porcupine.

The new journal is owned and edited by Mr. Ben Hughes, who for several years has been resident at Cobalt, and is very familiar with the district. He has been a regular correspondent for several daily newspapers and has gained an enviable reputation as a contributor of reliable information.

Mr. Hughes is one of the Canadian Mining Journal's regular correspondents, and is responsible for the Cobalt and Porcupine news printed in our "Special Correspondence" section. He needs no introduction, therefore, to our readers. Those who are especially interested in Ontario silver and gold mines will welcome the "Northern Miner" because they know they can rely on Mr. Hughes' statements.

The article in this issue on Coke Oven Chemistry gives a clear account of the process of benzol recovery, which is a matter of considerable interest just now. The Dominion Coal Company has made arrangements for the installation of a plant at Sydney to recover benzol.

Alien enemies in the mining camps are enjoying unusual liberties. It is not likely that men who go about their work quietly and recognize that they owe something to the country which affords them a living, will be denied employment. There is, however, a growing demand that alien enemies who make themselves obnoxious should be taken to detention camps and their positions given to men who are loyal to the country in which they live. The mining camps should not be allowed to become a refuge for enemies of the Empire.

The Alexo nickel mine at Kelso, Ontario, made a new production record in March, sending out twenty-eight cars of nickel ore to the Mond smelter at Coniston. The Kelso, compared with some of the Sudbury properties, is a very small mine with a very small plant; but it is being steadily and profitably worked.

A new phase in the development of the Kirkland Lake gold district has begun with the completion of a mill and cyanide plant at the Tough Oakes mine. Development work at this mine soon showed that an important ore deposit had been found. Production to date has been from hand picked ore and from ore treated in a 5-stamp mill. Production on a large scale has only just begun.

Power trouble at Cobalt, due to lack of water, is reported to have vanished with the warmer weather. The advantage of having auxiliary steam plants has during the past few weeks again been demonstrated to users of hydro-electric power in Northern Ontario.

The Minister of Mines of Ontario has announced that there will be no further extension of time for the performance of work on mining claims. An Order-in-Council, passed last year, provided for exclusion of the period August 15, 1914, to April 15, 1915, in computing the time in which work should be done by claim holders. The decision to grant no further extension will no doubt be welcomed by men looking for work.

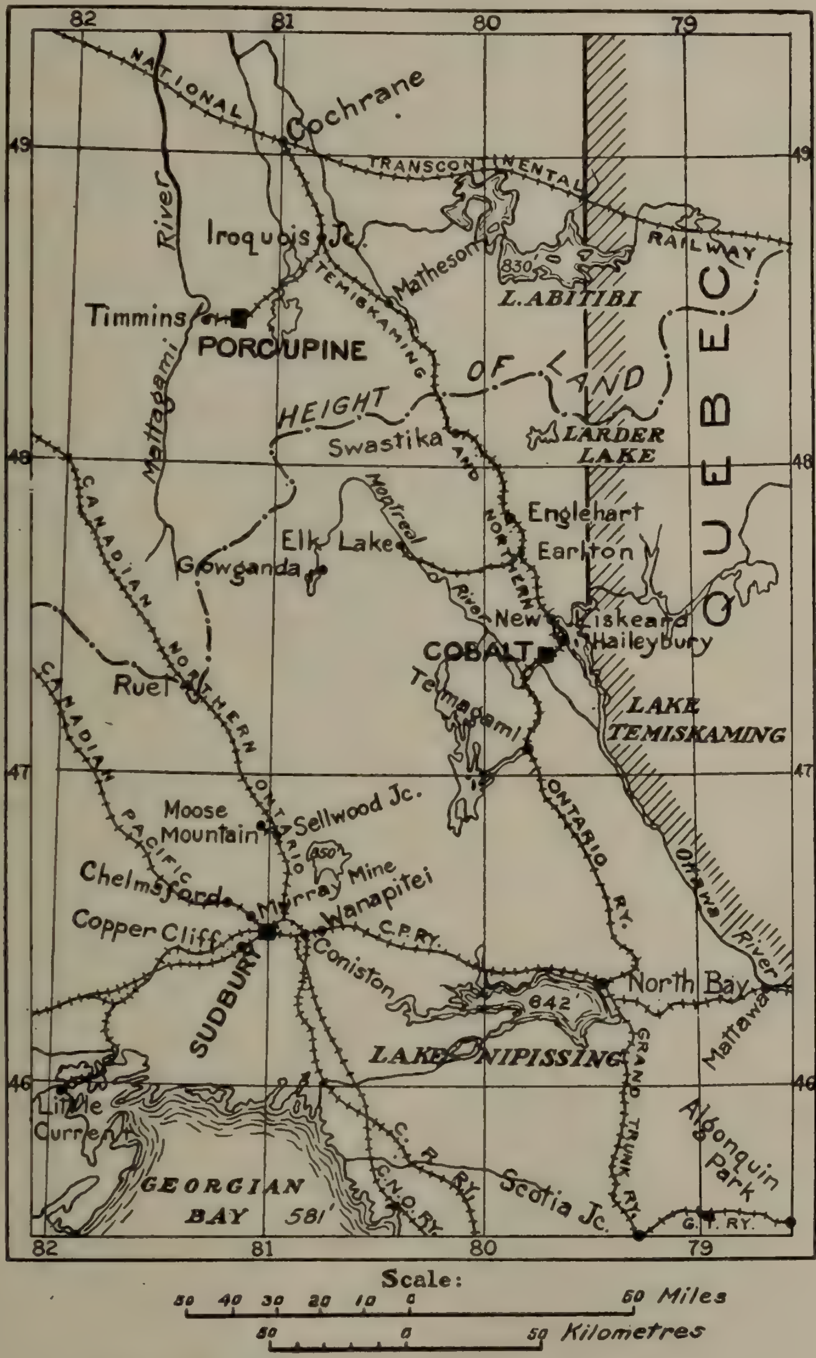
With the payment of the four per cent. dividend on April 22, Hollinger entered the list of mines which have returned their capital. Hollinger has now paid $3,060,000 in dividends, and the mine has just got nicely started on its career of production.

The visit of Mr. Joseph Leiter, of Chicago Wheat Pit fame, to Cobalt early in April is taken to indicate that this well known speculator is now interested in Northern Ontario mines. However, no danger of a "corner" need be feared.

PRESENT CONDITIONS AT COBALT AND PORCUPINE

During the past few months decided improvement has been made in the physical condition of several gold and silver mines in Northern Ontario and the indications point to increased activity during the coming summer. The price of silver, about 50 cents per oz., has not been good since the war began and has seriously affected the profits of Cobalt mines. Another adverse factor has been a shortage of power, the water supply being inadequate. In spite of these disadvantages there is good reason to be optimistic over the prospects of Northern Ontario's metal mining industry.

At Cobalt some well known mines have passed their most profitable period of operation, and during the past year a few have been almost completely worked out. That there is still a lot of silver ore to be mined, however, is indicated by the recently issued reports of some companies.



Cobalt, Porcupine and Sudbury Mining Districts, Ontario

Nipissing, the largest producer at Cobalt, has just reported for 1914 a profit of $1,578,715, of which $1,235,000 was paid out in dividends. In spite of the large output the company has been able to increase its ore reserves to about 10,000,000 ounces silver. The develop-

ment work necessary in placing new ore in sight has been paid for while the cost per oz. produced has been reduced. The year's record is a very satisfactory one. The company has a large ore reserve, a considerable area not yet developed, and started the present year with a surplus of $1,602,776.

Aside from the unexpectedly good report of the Nipissing company perhaps the most notable report is that which will be made by the Temiskaming Mining Company. Temiskaming has had a more spectacular career than many of the Cobalt mines, owing largely to the nature of its ore bodies. The mine has produced some very rich ore for a time and then been almost without reserves. Last summer it was in the latter condition. New work, in a portion of the property formerly unexplored, has resulted in the discovery of an important ore shoot. The successful results of the development work on the Temiskaming must be encouraging to the owners of neighboring properties.

At Porcupine the development of gold ore at the Hollinger and Acme mines, and the additions to plant for

Hollinger and Neighboring Properties

mining and treating the very valuable ore bodies, have been going on steadily during the past year. Hollinger produced in 1914 $2,688,354 from 208,936 tons ore yielding a gross profit of $1,786,679. $1,170,000 was distributed in dividends and $451,058 added to surplus. During 1915 operations are to be continued on an increased scale. Additions to plant completed or in course of completion will permit a substantially larger tonnage being mined and treated. The Acme will soon be in a position to produce a large quantity of gold. This property is owned by the directors of the Hollinger.

During the past few weeks a great change has taken place in the market value of Dome mine shares. The Dome has made no great increase in output recently nor has the grade of ore treated been high. The change in price has, therefore, been the subject of much comment, especially as it coincides with a change in the directorate. It is understood that during the past few months exploration by horizontal drill holes has resulted very satisfactorily. It is reported that at the sixth level cores from drill holes in a large orebody averaged $18 per ton. This ore has not yet been opened up. Most of the development work so far done at the sixth level is a drift in the foot wall, parallel to the orebody.

That the Dome has a very large tonnage of ore that should yield a profit of from $1 to $2 per ton is well known. If, in addition to this ore, any considerable body of high grade is encountered handsome profits should accrue. It is understood that mining costs have been reduced to $2.50 per ton of ore mined.

While Hollinger, Acme and Dome mines are likely to be the largest producers, there are several other profitable mines now being operated at Porcupine. Of these McIntyre and Porcupine Crown have been steadily operated. The Vipond, which was closed down for some time, has made a good record since it was re-opened last summer and should be an important producer this year. During the past six months considerable new ore has been opened up at these three mines, and their successful operation will doubtless lead to renewed activity on neighboring properties.

MINING IN THE ROSSLAND DISTRICT, B.C.

Mining in Rossland continues on a scale not approached in former years. For several months production has been kept uniformly in advance of last year by from five to eight thousand tons per month. The month of March, just closed, affords a fair example of the extent of the shipments and of the increase noted. In railway shipping figures, Rossland mines shipped 27,472 tons to the Consolidated Company's smelter at Trail, in March, divided as follows: Centre Star, 16,301; Le Roi, 10,881; Josie, 2,030. In March, last year, these mines shipped 20,513 tons, as follows: Centre Star, 13,571; Le Roi, 5,200; Josie, 1,742. There are no new shippers this year.

Indications point strongly to the re-entry of the Bluebird mine among the shippers. The property is owned by the Rosalia Mining Co., Ltd., formerly the Bluebird Mining Co., and is situated in the South Belt of Rossland. An option on the property has been taken by E. L. Tate, of Spokane, who recently had the mine unwatered for inspection. The examination was made by Roy A. Clarke, M.E., Spokane, who is said to have reported favorably on the condition of the property and on the assays, to Mr. Tate. Preparations are being made to operate the mine.

The Richmond Consolidated Mining Co., Ltd., is making efforts to continue the work on its South Belt property, suspended a year ago.

While no official announcement has been made, it is known that recent development work in the Centre Star mine of the Consolidated Mining and Smelting Company of Canada, has resulted in the continued discovery of valuable ore bodies at considerable depth.

While blasting in the Centre Star mine, April 2, Stephen Allan was blown to pieces. The coroner's jury brought in a verdict of accidental death, due to the discharge of a missed hole. Mr. Allan was the oldest blaster in Rossland, having followed the occupation for eleven years. A widow and four children survive. This is the first fatality in Rossland mines in a year.

The placer diggings along the Tulameen river, in the Similkameen district of British Columbia, are attracting many miners who have had placer experience in the Yukon and elsewhere. Several have gone from Rossland.—H. B. C.

The annual meeting of stockholders of Nipissing Mines Company, will be held at the office of the Company, at the Granite Bank Building, 242 Water Street, Augusta, Maine, on Monday, April 26. 1915,

THE SOURCES AND USES OF MOLYBDENUM ORES

A Memorandum issued by the Imperial Institute, London.

At the present time there is an exceptionally large demand for "steel hardeners." Two of the chief materials employed for this purpose are molybdenum and tungsten. Before the outbreak of war, Sheffield was largely dependent on Germany for its supply of the latter metal in the proper condition for making "high speed" steel. This was mainly because British manufacturers were not conversant with the best methods of extracting the metal and preparing it in the proper condition; now, however, they have largely solved the problem, and the metal is being produced in Great Britain. It is probable that this is only the beginning of a movement for the production of similar metals in the United Kingdom.

The great demand for the so-called "special steels" has increased the demand not only for tungsten, but also molybdenum, and early in December, 1914, molybdenite ore, containing the equivalent of 90 per cent. molybdic acid, was quoted at £6 10s. per unit per cent., or £585 per ton of 2,240 lb.

The widespread use of molybdenum has hitherto been hindered by the irregularity in the supplies of ore and the consequent high cost. The principal hindrance to the exploitation of known deposits has been the lack of satisfactory methods for concentration. A standard ore should contain a minimum of 85 per cent. of molybdenite (molybdenum sulphide, MoS_2). American buyers are stated to require concentrates containing 90 to 95 per cent. of molybdenite. The presence of copper, arsenic, bismuth or tungsten reduces the price of the ore.

Uses of Molybdenum.

The addition of molybdenum to steel increases the hardness, toughness and elongation of the metal. Molybdenum high speed steel, as used for machine tools, contains 8 to 10 per cent. of molybdenum, and is extremely hard and will retain its cutting properties even when raised to a high temperature.

The compounds of the metal are also used in scientific work, and as pigments in various arts and industries. The ammonium sale of molybdic acid is largely used in steel works and other laboratories as a reagent for the estimation of phosphorus in steel, soils, etc. Large quantities of molybdenum are consumed in this way. Molybdenum compounds are also used for the production of a yellow color on porcelain.

Occurrence and Output of Molybdenum.

Ores in the British Empire.—The only molybdenum ore of importance is molybdenite, MoS_2. It is widely, though usually sparingly, distributed, and is known to occur in the following countries of the British Empire: England, Scotland, Australia, New Zealand, Canada, Newfoundland, South Africa, India, Ceylon, the Federated Malay States and the Virgin Islands in the West Indies. It is also found in the following foreign countries: Austria, France, Germany, Russia, Norway, Sweden, the United States, Japan and Mexico.

The following information relates only to occurrences within the British Empire:

Australia.—During 1913 more than half the world's production of molybdenite ore came from Australia, mostly from Queensland.

Queensland.—The annual report of the Under Secretary for Mines for the year 1912 states that the output of molybdenite in that year was 102 tons 6 cwt., value £17,349, as compared with 99 tons 10 cwt., value £13,278, in 1911. The Larkin mine, the property of the Irvinebank Company, maintained a monthly output of 1½ tons of molybdenite. Molybdenite was also obtained in the vicinity of Ollera creek, in the Townsville mineral field, to the amount of 17 cwt., value £143.

The output of molybdenite in Queensland in 1913 is given as 57 tons 2 cwt., value £16,185.

New South Wales.—Most of the molybdenite produced in New South Wales is obtained from the Whipstick mines, in the Pambula division, from which 73 tons of ore, valued at £6,400, were raised in 1913. The annual report of the Department of Mines for 1913 states that the total quantity of molybdenite exported in 1913 was 78 tons 16 cwts., valued at £6,802, as compared with 56 tons 11 cwts., valued at £3,706, in 1912. In the Deepwater division, the Bow Creek molybdenite mines raised 70 tons of crude ore, valued at £1,000, whilst at Kingsgate, in the Glen Innes division, a vigorous policy of devolpment was pursued during the year. A discovery of molybdenite, associated with other minerals, was made in the parish of Wunglebong, in the Tenterfield division, and the indications are said to be promising.

Molybdenite has also been found in South Australia, Western Australia and Tasmania, and specimens of the ore from these areas may be seen in the public exhibition galleries of the Imperial Institute.

New Zealand.—An occurrence of molybdenite was recorded in New Zealand in 1905 on the lower slopes of the Paparoa range, near Greymouth; but the deposit does not seem to have been worked hitherto.

Canada and Newfoundland.—There are numerous occurrences of molybdenite in Canada and Newfoundland, but there has been very little production of the mineral. In 1913, there was some prospecting activity in Ontario, Quebec and British Columbia. It is reported that a mine in British Columbia despatched a carload of high grade material for milling in Denver, and that a small trial shipment of the Ontario ore was made to England.

Virgin Islands.—Specimens of minerals from an abandoned copper mine at Virgin Gorda, Virgin Islands, were examined at the Imperial Institute in 1907 and found to contain molybdenite and molybdenum oxide. One sample represented material which would be worth concentrating if large supplies of the ore were available for treatment.

Ceylon.—Deposits of molybdenite occur in Ceylon at Hettimulla, four miles south of Ksgalla. A sample examined at the Imperial Institute in 1906 consisted principally of molybdenite, and contained nearly 51 per cent. of molybdenum, but according to the Progress Report of the Ceylon Mineral Survey the molybdenite bearing pegmatite deposit was neither extensive nor rich in the mineral.

Federated Malay States.—In the Federated Malay States molybdenite was observed by the Government Geologist in 1905 in a granite quarry near Bukit Panjang.

India.—There is no record of molybdenite having been worked in India. It has been observed in small quantity in the Patra river, near Mahabagh, and the Baraganda copper mine at Urmi, near Dumri, Hazaribagh district, Bengal; in parts of Chota Nagpur; in Rajputana and Mandaoria, near Kishangarh; and in Burma, on the road from Tavoy to Myitta. Molybdenite also occurs disseminated through the Travancore pyrrhotites and might possibly be worth separating from the ores should these ever be worked for copper and nickel.

Union of South Africa.—Outcrops showing molybdenite ore occur at Impendhle, at the foot of the Mahotoya range, Hlatimba river, Natal. A sample of ore from the Buschveldt district, Transvaal, examined at the Imperial Institute in 1906 contained molybdenite. Wulfenite, a molybdate of lead, has been found in small quantities in the Transvaal silver mines, Leydsdorp district. It is considered likely that molybdenite may occur in the vicinity.

United Kingdom.—In the British Isles molybdenite has been met with in the Cornish copper and tin mines, but usually not in paying quantities. It is stated to have been worked in Inverness-shire. It occurs at the Mount Sorrel quarries of Charnwood Forest, Leicestershire, and is said to have been raised at Calbeck Fell in Cumberland.

The Imperial Institute will be glad to place producers of molybdenum ores in communication with prospective buyers.

THE MICHIGAN COPPER INDUSTRY

The very satisfactory condition of the copper market and its effect on the Michigan copper mining district is reviewed editorially by Mr. Homer Guck, of Houghton, in the Mining Gazette, of April 3. He says:

An era of prosperity the like of which the Lake Superior copper camp has never known and which cannot but extend to all the other copper camps, is predicted by Michigan copper men. The European war, which caused partial suspension of mining and curtailment in general in this part of the country last fall, is now the agent of prosperity for the copper manufacturing industry, boosting metal prices to figures that have not been reached before since 1906. Activity at all the copper mines is normal and bids fair to become abnormal if the war keeps up. The suspension of war in Europe could mean a decided decrease in demand for copper metal for manufacture of war munitions, likewise it would mean the reopening of the great brass and copper foundries and manufacturing of brass and copper goods in Europe. This would add to the greatest demand for copper the world has ever known. The words of two prominent Belgian copper manufacturers who visited this section recently are recalled in this connection. According to these gentlemen Europe's crushed industries will spring into life anew and a great work of rehabilitation that will consume millions of lbs. of copper will be taken up. Metal needed to rehabilitate the great railroad and telegraph and telephone systems, alone, will mount into figures that cannot even be guessed right now. All Europe is running short of not only copper but steel for the largest of the warring nations have for years obtained the greatest supplies of their iron and steel from North America. The constant destruction of immense quantities of copper and brass war munitions merely means that the manufacture of these materials must be continued till the war ends and thereafter until universal peace comes.

Advices from the continent of Europe are that even the exploded shells are gathered from the battlefields that the copper and brass in their makeup may again be used, to such a pass have come Germany, Austria, Russia and other nations in their absolute need for copper metal. It is understood, too, that in the great naval shipyards in England, France, Germany and Russia more copper than ever before is specified for use in the armament of the great naval fighting machines. Experiments are being conducted by several nations with copper armor to bottom cruisers and battleships, the belief being held that its elasticity and toughness will make it nearer impervious to damage by mines and torpedoes than is either steel or any other substance. Steel armor, covered with heavy plates of copper, is being experimented with in some of the shipyards.

Practically all of the copper mining companies are taking on additional men, both for underground and for surface work and in the mills and smelters. The Calumet & Hecla company has added to its crews at its mills and smelters. The Copper Range is increasing its forces, while the Quincy is reported to have taken on about 40 men in the past month. The Tamarack Mining Co., which is preparing to resume rock shipments to the mills, will bring its forces up to about 350 men within a few weeks and later will increase them to 500 or more. The Isle Royale, as soon as it is given more milling facilities through the completion of its own three-head mill at Isle Royale sands, will increase the crews underground, besides taking on full crews at the mill. Three shifts will probably be worked at the mill and the daily copper rock production of the mine will be brought up to 3,000 tons.

About 4,500 men have benefited through the wage increases reported this week by the Copper Range Consolidated and the Quincy companies. Resumption of operations at the Algomah property in Ontonagon county will give employment to a limited number of men. At this property the shaft, which now is down 415 ft. is to be deepened until it approaches closely enough to the Algomah and South Lake group of lodes to make crosscutting practicable.

Forces at the White Pine property will be added to materially as soon as the whole plant is in running order.

Work at this property is to be crowded, both underground and in the crushing plant and the mill. Probably about 300 men will be employed in these plants and underground, besides which there will be a large surface crew. Most of the large shop work will be done, of course, in the Calumet & Hecla plant. The construction of a railroad from Ontonagon to White Pine is probable this summer. Operations at the Hancock mine will require additions to the underground forces within the next two or three weeks. Franklin mine, which can hardly start shipping before May 1, will also likely enlarge its crews. New Arcadian, which will send its first shipments to the Franklin mill within a few days, will not put on larger crews for some time as all shipments will be made from the large stockpile for some time to come, while the lode is being explored and developed by the present crew. No. 18 shaft of the Calumet & Hecla, which was closed at the time of general curtailment last fall, will take additional men. At the time this shaft was closed stoping was carried on up to the second level. Sinking was stopped last fall at shafts 6 and 7 of the South Hecla branch but may be resumed within a few weeks.

BEAVER CONSOLIDATED MINES ANNUAL REPORT

In submitting their report for the year ending February 28th, 1915, the directors of Beaver Consolidated Mines, Ltd., say in part:

Our operation for the past year was interrupted for a period of nearly two months, and from August 8th to October 1st our underground work was suspended entirely. The European war has seriously affected the market for our product, the average price for silver for the months of August and September being 53.81 cents an ounce as against 59.96 cents an ounce for the same months of 1913. For a time there was no official quotation on silver, but finally quotations were made from day to day. Since September, the price has dropped to as low as 47⅝ cents an ounce, but we have sold enough of our product at from 49 cents to 50 cents an ounce to take care of operating expenses.

When we resumed operations we did not engage as large a crew as had previously been working, but gave preference to married men who had been with the company for a long time. We have therefore maintained our efficient organization and we think our men have amply repaid the company by their loyalty and good service.

Our system of inspection, which has been of such good service, is still continued. This is an added expense over and above what we have to pay on account of the Workmen's Compensation Act, which went into force in the Province of Ontario on January 1st, 1915. We do not feel, however, that we would be justified in dispensing with the office of mine inspector on our property, as our aim is to protect our men as far as we can from the possibility of any accident.

Following is the record of development and stoping for the year:

	Feet.
Drifting	3,094.0
Crosscutting	1,393.0
Sinking	100.7
Raising	507.0
Total	5,094.7

Stoping, 5,807 cubic yards.

Station cut at the 900 ft. level.

Practically no further work has been done on the 200 ft., the 300 ft. or the 350 ft. levels. On the 400 ft. level, in a crosscut about 125 ft. west of the shaft, we encountered a very rich vein. We first struck this vein on the 530 ft. level and then drove crosscuts on the 460 and 400 ft. levels to develop the vein toward the surface. Since resuming operations in the fall, most of our work has been centred in developing this new vein on these different levels, from which we have taken many tons of ore. A great deal of work remains to be done above the 400 ft. level as well as below the 530 ft. level. It looks very much as if we had an entirely new vein system west of the one which has been and is still so productive. Very little work has been done during the last six months on the 600, the 700 and the 800 ft. levels on account of our reduced force. Previous to closing down in August, we had sunk the shaft to a depth of 900 ft., had cut the station at this level, and intended to continue further development at depth, but, under existing conditions, did not deem this advisable. However, with a reduced force and also a cessation of operations during a period of two months, our production for the year is the greatest we have had during the life of the company. While we are working in high grade in a number of places in the mine, we still desire to adhere to our policy not to undertake to estimate what we may have in place, owing to the erratic nature of the ground.

We have a large mill feed ahead, having approximately the same as last year or close to 45,000 tons (12,500 tons on the surface and about 32,500 tons on stulls underground), which we estimate will give us 1,200,000 oz. of silver. All the mining costs on this have been paid, but the mill costs still remain, and we estimate it will cost to raise this ore, mill it and put it in the form of concentrates for the smelter, less than $100,000.

During the year our mill handled close to 100 tons a day. The mill was shut down for two weeks in August at the time we closed the mine, and we have also been compelled to shut down at various times during the past winter on account of shortage of power in the Cobalt camp: Ore milled, 26,724 tons; concentrates produced, 347.95 tons; silver in concentrates, 415,707.86 oz.; earnings, less milling and marketing costs, $158,465.85.

Beaver Auxiliary.—At the time we closed work at the Beaver mine (August 8th, 1914) operations were suspended also at the Beaver Auxiliary, and we have thought it good policy not to resume during the present disturbed conditions. Previous to closing down we had sunk the shaft to a depth of 330 ft., and had done considerable crosscutting and drifting. The result of this work from a milling standpoint is very encouraging. Early last spring a dam was built across a ravine in order to create a reservoir for water supply, as a year ago we had considerable trouble and expense to supply the plant with water. We have on hand fuel sufficient to operate the plant for some months.

The Beaver Consolidated owns sixty acres outright, and three-quarters of the stock in the Beaver Auxiliary Mines Company, the holdings of which are one hundred and twenty acres.

Silver production.—Our production during the year was 900,000 oz. of silver, or 137,301 oz. more than the production of 1913-14, which, up to that time, had been our largest year. Of this 900,000 oz. of silver, we have sold 390,878 oz., and we still have in bullion in storage and in ore at the smelters, 509,122 oz. The cost of production was 21.54 cents an ounce.

Capital Expenditure and Dividends.—We have invested on capital account $35,128.25; we have paid one dividend of $60,000, and, exclusive of ore in dump and in the mine, we have ore on hand, ore in transit, bullion in store and due from smelters, aggregating an estimated value of $247,833.58, all of which appear in the financial statement.

Balance Sheet Beaver Consolidated Mines, Ltd., Feb. 28, 1915.

Assets.

Cash on hand and in bank		$18,642.04
Inventories on supplies		10,232.32
Unexpired insurance		2,464.09
Unexpired stock transfer expense		184.25
Unexpired Workmen's compensation		1,048.00
Accounts receivable		5,064.40
Due from smelters		31,282.62
Ore on hand	$92,471.17	
Ore in transit	39,739.15	
Bullion in store	84,340.64	
		216,550.96

Cobalt Mines Hospital stock		350.00
Beaver mine		1,000,000.00
Buildings and Timbering		66,660.81
Machinery, plant and equipment		114,832.36
Furniture and furnishings		5,875.96
Development		82,934.15
Preliminary and administrative		14,578.35
Incorporation and organization		2,049.70
Erie mine property		1,500.00
Beaver Auxiliary Mines stock		141,750.00
Temiskaming Mining Co.'s stock		9,928.82
		$1,725,928.83
Discount on shares		863,973.07
Liabilities.		$2,589,901.90
To the Public—		
Pay roll, February, 1915.	$6,798.31	
Unclaimed wages	72.13	
Accounts payable	9,009.33	
		$15,879.77
To the Shareholders—		
Capital stock	$2,000,000.00	
Depreciation account	93,040.79	
Profit and loss balance	480,981.34	
		$2,574,022.13
		$2,589,901.90

THE EMBARGO ON TIN.

The announcement in the "London Gazette" of Friday last that, inter alia, tin, chloride of tin and tin ore had been added to the list of articles the exportation of which is prohibited to all countries other than British Possessions and Protectorates passed almost unnoticed by the general Press at the time, but the Metal Markets were prompt to realize its significance, and the sharp fall which has since taken place in tin values shows how the industry is likely to be affected. Though sympathizing, however, with the shareholders of tin mines, whose hopes have thus been disappointed, the recent course of the market shows that the step was necessary in the national interest, if only to prevent prices from going to an unduly high level. While not of the same vital importance as copper, tin still enters very considerably into the manufacture of military stores, and it is, of course, of vital importance to the meat packing industry. It is understood that licenses for the export of the metal will be granted, but only under such restrictions as will ensure that it does not pass into the enemy's hands, and it is to be presumed that, while the Order in Council only applies to the United Kingdom, similar measures have been taken to prevent exports from the Straits Settlements and other British Possessions. Financial Times, London.

MR. SCHWAB ON STEEL OUTLOOK.

New York, April 6.—At the annual meeting of Bethlehem Steel Company, President Schwab said:—"The past year has been gratifying to Bethlehem Steel Co. officials, and, I hope, to stockholders. Stockholders have been rewarded for their patience in now being able to realize substantial profits on their securities. While the year has been very bad for general steel business the Bethlehem Co. has been fortunate in being engaged in the manufacture of lines which are in strong demand."

Mr. Schwab did not touch upon the question of a common dividend except to say "Between $20,000,000 and $30,000,000 will be necessary to spend on the Chilean property and Bethlehem plant in this country, and this should be spent out of the earnings as our bonded indebtedness is larger than our capital stock. I hope that stockholders will approve of this policy."

Mr. Schwab further said he did not want to say anything that could be construed as approving or showing any connection with the stock market, and for this reason had nothing to say about dividends. He said he was not interested in the stock market movements in any way.

Speaking of the outlook for business this year, Mr. Schwab said:

"The general business outlook is encouraging. I think the steel business will show an improvement in volume of orders but I hardly look for much higher prices."

The retiring directors were re-elected. About 25 stockholders were present. Out of 297,700 shares of stock there were represented 212,319.

MOOSE MOUNTAIN DISTRICT, ALBERTA.

The Geological Survey has published a second edition of Dr. D. D. Cairnes' report on the Moose Mountain district, Southern Alberta. The report and the map which accompanies it cover an area lying south of and adjoining the Bow river and extending from the main Rocky Mountain escarpment on the west, to include part of range III, west of the 5th initial meridian, on the east, and extending south to township 18, i.e., to a short distance south of the south branch of Sheep river.

Coal had been found in several places within this district and natural gas had been found to the north, south, and east of this area in the same formations as those within it.

NIPISSING.

The report of the Nipissing Mining Company, Ltd., for the year ended December 31 last, discloses total income of $2,558,732, of which $2,516,065 was derived from ore production. These figures compare with the previous year at $2.804,093 and $2,756.612 respectively. The net profit for the year is given as $1,578,715, which compares with $1,645,108 in 1913.

Dividends paid in 1914 amounted to $1,235,000, and surplus was increased from $1,259,061 to $1,602,776.

INTERNATIONAL NICKEL CO.

New York, April 6.—As the result of increased orders received recently by the International Nickel Co. earnings on the common stock in the fiscal year begun this month, are expected to get a new higher record at 12 per cent. or better. March is reported as one of the best months in the company's history. Part of the demand for nickel is due to the introduction of a cartridge made exclusively of copper and nickel. Inquiries were recently made for the placing of a trial order of 5,000,000 of such bullets.

TRANSVAAL MINING.

Speaking at the meeting of the Lace Proprietary Mines, Ltd., Mr. Llewellyn Edwards said the exploitation of additional areas of the Eastern Rand was more a State problem than one for directors and shareholders, supporting his contention by instancing the British policy of supporting the credit of industrials.

PROGRESS IN METALLURGY*

By James Douglas.

As life advances one is inclined to look backward instead of forward, and the vista over which my memory carries me has been filled with such a shifting panorama of changes in metallurgy that the whole practice of the art seems to have been recreated.

The first cupola furnace that I ever saw in operation was at one of the group of mines at Capelton, Quebec, from which the Nichols company still draws some of its sulphur supply. At that time it was operated by a Hartford, Conn., company, under a General Adams. When its small brick furnaces made a campaign of a week and smelted 10 tons a day, the feat redounded to the credit of the operator.

The introduction of the water-jacketed cupola dates forward to the next decade. I was using one in Pennsylvania making copper matte, to the horror of a noted metallurgist, who could not conceive it possible that you could bring fused sulphides into contact with steel without rapid corrosion. In our ignorance we were doing what seemed to be an impossibility, and it is just that recklessness and disregard for precedent which has characterized so much of the work of American metallurgists, and carried us forward at such headlong speed.

Once the water jacket was accepted as the type of the copper cupola, its almost unlimited expansion in length, but not in width, was a matter of convenience rather than of skill. In Butte the cupolas have been enlarged by adding furnace to furnace.

The first reverberatories which I saw in operation were those in Professor Hill's Black Hawk establishment, where the concentrates from the Gilpin county gold mills were run down into matte for separation in England. Smelting was done with wood as fuel, and the capacity of the furnace was about 10 tons per diem. Shortly after this Professor Hill formed an alliance with Richard Pearce, who was running what, if I recollect aright, was called the Swansea works, at the bend of the river approaching Georgetown.

Mr. Pearce had been engaged in the separation of precious metals from copper products in Wales, and applied his skill to the local separation of the Black Hawk mattes. Soon the operations were shifted to the larger works at Argo, near Denver, where for many years the Ziervogel method was practised with much success. And to Pearce is due the credit of taking the lead in gradually expanding the size and capacity of the reverberatory, for at Argo and at the company's branch works at Butte this type of furnace grew rapidly in dimensions to 35 by 16 ft., and a capacity of 50 tons.

Big as these were, they were pigmies compared with the huge reverberatories of the present day, heated by oil or coal, smelting as much as 660 tons of charge a day, and fulfilling what the old metallurgist dreamed of as a possibility, but failed always of securing as a reality—the recovery of the waste heat in the form of power. (Mathewson's Development of the Reverberatory Furnace and my Cantor Lectures.)

The fate, however, of the Argo works, despite the science and experience which Pearce brought to bear upon his operations, was virtually sealed when the combined forces of the pneumatic method and the electrolytic separation came almost simultaneously to the aid of the metallurgist. The converter brings the matte to metal in a space of time measured by minutes. Electricity at one operation refines the copper and separates the precious metals, simplifying the process and saving time and money. The Argo works had therefore to go out of blast, and the metallurgist retire before the engineer and the electrician.

And so one has watched change follow change, machinery in every case taking the place of hand labor; and inasmuch as mechanical force can be generated to an almost unlimited degree, the rate of production has kept pace with the contrivances for generating and applying power. Thus it has come about that the trifling amounts which were made within the memory of man have increased to the stupendous production of to-day.

The changes have not been confined to smelting, but have been many and very conspicuous in the concentrating department. Isolated motors have in great measure abolished the countershafts; and grinding mills of many different makes have competed for acceptance in rapid succession. The National riffle has even displaced the jig in some mills, and now flotation is claiming to supplant all other methods. Whatever invention may for the time being claim supremacy, the experience of the past compels one to admit that the construction of the mill of the future should be so elastic that it can be altered with the least expense and embarrassment to suit the many changes which will become imperative. It will probably consist of a large square structure, within which the devices temporarily employed will be erected upon platforms and scaffolding which can be readily removed and replaced.

Iron.—We have been recalling incidents in the history of copper metallurgy, but it is the growth of the iron industry which excites our imagination and wonderment. Its consumption is really the barometer by which we can gauge the world's activity and the demand for other articles; for there is an economical relation in the use of one metal and another. As the demand for iron is the controlling factor, not only in the metallurgical world, but in the industrial world at large, it is iron which fixes the rate of production of virtually all the other metals. I pointed out some years ago that the relation of the consumption of copper to iron in this country was as 1 to 83. That relation has been maintained ever since, and holds good approximately in the world's consumption of iron and copper. That being the case, the demands for the metals, and therefore to a certain degree, the price which they will command in the market, depends upon the economic laws, which will inevitably override our attempts at interference. When these laws come to be better understood and submitted to as implicitly as we bow to the laws governing the forces of nature, the large groups of people who compose the industrial world, instead of engaging in rivalry, which is liable to degenerate into hostility, may possibly co-operate to advance the interests common to all. A world combine would be clumsy to handle, but a world's congress might pass international laws for the regulation of trade which would obviate some of the anomalies that exist to-day.

(*An address before the meeting of the New York Section, American Institute of Mining Engineers, Nov. 4, 1914.)

H. W. Hardinge.—I wish to acknowledge an unsettled credit due to Dr. Douglas of which he is probably not aware. When Dr. Douglas visited the Arkansas Valley Smelting Co.'s Leadville plant about 25 years ago, I was manager. A casual remark at the time by Dr. Douglas was the basis of certain changes in smelting operations through the conversion of a lead stack into a composite lead and copper furnace.

The furnace slags at that time, owing to a shortage of lead as a desilverizer, were running in the neighborhood of 3 to 4 oz. of silver per ton. Taking advantage of the suggestion by Dr. Douglas, as well as certain experiments already made by Herman Keller, the superintendent, one-half per cent. of copper, in the form of ore, was added to the charge. The resulting slags immediately dropped to less than 1 oz. of silver per ton. Later that portion of the slag dump, amounting to several thousand tons, which had been assaying unusually high, was taken into stock as an asset on the order of the president, A. R. Meyer.

At the time of these excessive losses in silver (which was when silver was selling at about $1 per oz.) the profit and loss balance had for several months been in "red," but within two months from the time the addition of copper was made to the charge, the monthly balance turned to a profit of $5,000, and to the best of my recollection a five months' average slag content of silver was 0.93 oz., and the balance for the fifth month changed to $17,000 profit; thus a casual remark resulted in the changing of copper smelting in Colorado, for up to that time the by-products of the lead furnaces in the form of copper mattes had been shipped from the State to the Orford Copper Co. and other refiners in the East and abroad. Shortly after this other smelters in Colorado adopted the same or similar methods, and within a year not a pound of the lead-stack copper mattes was shipped out of the State. The re-smelting of these slags, which had a good iron content, admitted of utilizing ores high in silica and at a correspondingly high smelting charge.

Previous to these and other experiments, lead-furnace mattes contained upward of 15 per cent. in lead, which was a detriment to the copper refining in the East, and for which a penalty was charged.

One of my colleagues in commenting upon the production of lead and copper in the same stack stated that it was impossible. This may have been a very well based opinion, but during the discussion there was a check upon my desk for $10,000 in payment for a shipment of this impossible product of lead bullion produced from the copper stack. The high-grade copper matte made in conjunction with the lead had been shipped to the Argo works, near Denver, where the silver and gold contents were extracted in reverberatory furnaces in conjunction with Dr. Pearce's "secret" method, which was also a subject treated in Dr. Douglas' previous remarks.

MINING IN MAYO DISTRICT, YUKON.

The following communication was made to the "Daily Province" of Vancouver, B. C., under date of February 8, by Mr. George Crisfield, of Galena creek, via Mayo landing, Yukon Territory:—

"As a resident and prospector of the Mayo district, Yukon Territory, I would like to correct a few impressions which were probably formed by the perusal of a certain article printed in one of the Vancouver newspapers. The article in question was an unqualified eulogy of the Mayo district as a land of opportunity for the workingman. I believe the final words were: You will make no mistake in coming to this Cobalt of the North, all we need is more people. I believe the writer of the article wrote those words without realizing how misleading they would be to the average worker looking for a market for his muscles.

"I would not like to see a large influx of laboring men into the camp looking for jobs, when jobs were extremely scarce. There are only four outfits employing labor in the placer diggings. They are as follows: The Minto Lake Hydraulic Co., which will employ probably eight or ten men at the most, since the completion of their ditches. Mr. Middlecoff probably employs fifteen or twenty men, while working two shifts. Another outfit working below Middlecoff on Highett creek employs from ten to fifteen men, while on Haggert creek, Abbott & Portlock employ probably six men.

"So you see at the very outside fifty men is all that can get work in the placer diggings. There are lots of men right here in the camp that need the work to fill that bill. The placer work generally begins the latter end of May and concludes in September, so it is a very short season.

"Then comes our so-called Cobalt of the North. At Silver King mine, owned by H. McWhorter, there are about ten men employed there at present and from all indications, although the overshoot is undoubtedly of good value, the crew will not be largely increased for some time to come. At present the mine may be said to be only a prospect, as far as permanency is concerned, for the full extent of the ore body is not known.

"Apart from that of the Silver King, there is only one vein uncovered up to the present and the value of that ore is problematical. This vein is about 2,500 ft. from the McWhorter workings. It is on the Adam claim, owned by Mark Evans, who is now sinking on the vein and is getting some good ore, but up to the present not in paying quantities. There are seven men prospecting on other claims in this vicinity and they are most of them finding some good float prospects, but that is all.

"Myself and Dave Robertson were, I believe, quoted as having located a rich vein on Lightning creek. Well, I hope it is true, but as we have so far done absolutely no development work it is impossible to say. The best that can be said of it is that it is a good prospect.

"Last spring the Mayo camp had been boosted a little too hard, consequently there were far too many men spent their hard-earned dollars to get here and had to go away disappointed. For a man with a grubstake who understands conditions in this northern country, I don't think a better country exists to-day to prospect in, but for a workingman looking for a job decidedly 'No!' I have been prospecting in the Mayo district for six years, so I know something about the camp, and I hope for the benefit of those who may have been enthused by the article I have referred to, that you will permit this effusion of mine."

It may be added that early in July, 1914, a shipment of 60 tons of ore from the Silver King Mayo district, was received at the Trail, B. C., smeltery.

Anaconda Copper Mining Co. has increased its production to about 80 per cent. of normal as compared with 50 per cent. for several months last year. The March yield of 19,000,000 lbs. was within 4,000,000 lbs. of normal output for this company's mines—23,000,000 lbs.

NON-METALLIC MINERALS USED IN CANADIAN MANUFACTURING INDUSTRIES*

By Howells Frechette.

(Continued from last issue).

Fuller's earth is used in the meat packing industry to clarify lard. The earth is usually ground to 120 mesh and is generally of English origin.

In the refining of petroleum a considerable quantity is used. For this purpose the earth is not ground so fine.

Small quantities are used to remove grease from woollen goods.

Graphite—Though one of the most important uses of graphite is for the manufacture of refractory articles, there is very little used in Canada for this purpose. In the manufacturing of crucibles, retorts, etc., flake graphite of a number of sizes is used. It should be of slow combustion and good thermal conductivity; but the amount and the chemical composition of the contained impurities are the main factors in determining the suitability of any graphite to this purpose. The presence of fluxing impurities would tend to shorten the life of the finished article, if not render it unfit for use.

Stove polishes consist essentially of finely ground graphite, usually 160 mesh, with which is mixed clay or some other material to act as a bond. Both the flake and amorphous varieties are used. Professor B. L. Miller says: "If flake graphite is used a higher lustre is obtained, which has a decidedly steel grey color. This is owing to the flattening out of the flakes on the metal surface when rubbed by the brush, and to the fact that light reflected from the surface of the flakes produces a higher lustre than when the amorphous graphite is used. Not infrequently both amorphous and crystalline flake graphite are mixed together to produce the desired results. With the amorphous graphite alone it is difficult to obtain a lustrous polish, while the crystalline flakes alone produce too light a color, but the combination of the two varieties will yield a black polished surface with expenditure of little labor. The polish obtained with the flake graphite alone, or with the mixture of the two, lasts longer than the polish obtained with amorphous graphite alone." For polish making purity is not of importance, from 70 per cent. to 80 per per cent. of carbon being usual.

The finishing step of the manufacture of gunpowder consists of polishing the grains with graphite. The powder is placed in a tumbling barrel with some very fine flake graphite and thoroughly mixed and shaken for some time. The thin film of graphite enveloping each grain acts as a protection against the absorption of moisture.

Graphite, on account of its extreme softness and unctuousness, is admirably suited for use as a lubricant. It is used in two manners; namely, dry, or mixed with oil or grease. In the accompanying tables, showing the consumption of minerals, graphite used in the manufacturing of these mixed lubricants is included, but only in a few cases record is made of the graphite used in the dry form as a lubricant. Flake graphite in various grades of fineness, from about 20 mesh to 200 mesh, is that employed and should be free from gritty matter.

Large quantities of graphite are used in the manufacturing of paints for special purposes, such as for covering structural steel work, iron and steel tanks and steel stacks. It produces a good weather and fume resisting paint. For this purpose a very fine, air-floated flake graphite is used. It should be free from grit and sulphide minerals.

In the casting of iron, it is desirable to coat the inner surface of the mould with some material which will prevent the metal from coming into contact with the sand of which the mould is made, and at the same time give to the casting a smooth surface. Graphite possesses certain properties which suit it to this purpose, and large quantities are used by the foundrymen. A fine grain, flake graphite is used, either alone or mixed with talc or "sea-coal."

Lead pencils are made by encasing thin rods of prepared graphite in wood to give the necessary strength. These rods are formed by mixing very finely ground amorphous graphite with clay, which is then molded into shape and baked. The hardness of the finished product depends upon the proportion of clay used and the temperature and duration of baking.

In electrical work graphite finds many uses on account of its conductivity, refractoriness and softness. For different uses various grades are employed, in all of which a high degree of purity is required, especially for the making of dynamo and motor brushes, in which case it must contain no grit.

Graphite is used by electrotypers for giving an electro-conductive surface to the matrix on which the electrotype is deposited. For this an extremely fine and pure grade of air-floated graphite is required. A very small quantity supplies the market.

Gypsum—The principal use of gypsum is for the manufacture of plaster of Paris, which consists of partially dehydrated gypsum. On heating finely powdered gypsum, within certain limits of temperature, it gives off part of its water of crystallization, but retains the power of again taking up a like quantity of water, and, at the same time, forming into a solid mass. This property of the calcined gypsum or plaster of Paris finds for it many uses in the arts and trades. A partial list of the uses is as follows: Wall plaster and decorations, moulds and patterns for various purposes, casts of art objects, etc., surgical and dental purposes, and as a cement. It is also the base of alabastine, used for tinting walls.

In the manufacturing of portland cement, gypsum is introduced into the cement for the purpose of regulating the rapidity of setting when mixed with water. Some cement mills purchase the gypsum ground very finely, while others purchase it in lump form or crushed to one-half inch. As a rule a minimum of 36 per cent. of sulphur trioxide (SO_3) is demanded.

Considerable quantities of ground gypsum and plaster of Paris are used by asbestos manufacturers in the manufacturing of pipe and boiler coverings, bill board, etc.

*Extracts from a report published by the Mines Branch, Ottawa, 1915.

In the paint making industry gypsum is employed in the manufacturing of "cold water paints," in which it acts as the body or vehicle for the color. It is also used to a lesser extent in the making of paints, mixed in oils. It should be pure white, very finely ground and free from grit.

Finely ground gypsum, when spread upon the soil, has the power of aiding in the decomposition of certain minerals and thus liberating plant-nourishing chemicals. It also plays a useful part when mixed with manure, which later is to be used as a fertilizer. It is used, either in its crude state or mixed with plant-nourishing materials, to form certain artificial fertilizers.

In the textile industry, very finely ground, white gypsum is used to some extent as a filler for cotton goods.

Iron Oxides—The principal uses of these ferruginous materials, aside from being used as sources of iron, are in the paint industry, where they are employed as pigments. Trueness and depth of color are the prime requisites. They should be very finely ground, and free from grit. They are used either raw or calcined, according to the color desired.

The very finely ground raw hematite produces the colors known as Indian red and Venetian red, but the principal source of these colors is from the residue from pyrite burning.

Besides the use of these materials for paint-making they are used to color mineral floors, sand-lime brick, match heads, rubber goods, paper and oilcloth.

Bog iron ore is used as a purifier of illuminating gas. It has the power of removing the sulphuretted hydrogen (H_2S), hydrocyanic acid (HCN), and hydrosulphocyanide ($HSCN$) from the gas. By exposing it to the air, after use, it becomes revivified and may be used again.

Iron oxide minerals are used as fluxes in the smelting of certain metals, and as desulphurizers and decarbonizers in open hearth steel making.

Mica finds a number of uses in the electrical industry on account of its dielectric strength, the ease with which it may be split into thin, flexible sheets, and in some cases on account of its transparency.

The following is a partial list of its uses in this industry: Motor and dynamo winding—commutator ring and segment insulators; electric lights—discs for interior insulation of light sockets, covers for fuse boxes; telephones—long, narrow slips on which fuses are mounted; electric heaters—pieces on which the resistance wire is wound, forming the heating elements of toasters, sad irons, etc., spark plugs—the insulation of some gasoline engine spark plugs is made of mica.

The mica is furnished to the consumers split to the necessary thinness and sometimes cut to shape. It must be free from electrical defects; that is, free from electro-conductive inclusions and in perfect sheets.

For commutator insulation, amber mica is best, as it wears, under the action of brushes, at the same rate as the copper which composes the segments of the commutator. It must be free not only from electro-conductive inclusions, but also from quartz and garnet.

For electrical purposes micanite is being extensively used. It is made by cementing together very thin, small sheets of mica into large sheets. For this purpose much of the small mica is used, which otherwise would be discarded as useless or else ground to powder.

Mica, on account of its transparency and resistance to the action of heat, is admirably suited to use as glazing for stove doors, furnace peep-holes and chimneys for lamps, lanterns and gas burners. Muscovite is generally employed, though phlogopite is frequently used. Transparency and freedom from stain are the prime requisites for these purposes.

Finely ground mica, free from quartz and garnet, is mixed with a heavy grease for lubricating purposes.

In order to produce a scintillating surface on wall paper very finely ground white mica is employed. For this purpose the mica is ground under water. It should be from 100 to 150 mesh and as nearly uniform in size as possible.

Coarsely ground mica is used in the surfacing of certain prepared roofings. Cheapness is the main consideration in selecting this material. Any variety of mica may be used.

In addition to the above uses there are many others of lesser importance.

Mica Schist—An increasing number of foundrymen are substituting mica schist for the firebrick used for lining cupolas. The rock is broken into convenient size and shape, about six or eight inches long, four or five inches wide and a couple of inches thick, and cemented into place with fireclay and fragments of the rock itself. It is reported that very good results have been obtained at a considerable saving over the cost of firebrick lining. It is used also to advantage in the patching of cupola linings, either on brick or schist.

Mica schist is used to some extent in boiler settings.

Mineral Phosphates—The major use of mineral phosphates is in the manufacturing of fertilizer. Since the tricalcic phosphate, of which they are composed, is only slightly soluble in water, it is customary to convert it into more readily soluble monocalcic phosphate, that it may be in a better condition to nourish plant growth. Some fertilizer manufacturers perform this operation themselves, while others prefer to purchase the material in the form of acid phosphate.

Phosphorus is manufactured from mineral phosphates by a process of reduction in an electric furnace. A considerable quantity of apatite and pebble phosphate is consumed in Canada for this purpose.

In order to enrich the phosphorus bearing basic slags from steel furnaces phosphates are occasionally added to the charge. Such slags are used as fertilizer ingredients.

A small quantity of apatite is used for making a high grade of acid phosphate, which is employed in the compounding of certain baking powders.

Peat—Aside from the use of peat as fuel, it is employed for several other purposes.

Owing to the potash and nitrogenous matter contained in it, peat makes a valuable fertilizer material. Humified peat is dried, ground and mixed with chemical or artificial fertilizers as a "filler." It not only introduces nitrogenous matter and potash in a suitable form, but owing to certain physical properties which it possesses, it tends to beneficially modify the soil on which it is used, improving its texture, and in the case of light, sandy soil increases its retention of water.

Peat litter is used to absorb liquid manures, blood and wet tankage, after which it is dried, ground and sold as fertilizer.

Pebbles—In the grinding of materials a certain type of machine is sometimes used, known as a pebble mill. The material to be pulverized is charged into the cylinder, which is rotated. The constant shifting of the pebbles contained grinds the material to a high degree of fineness. This type of mill is extensively used in the grinding of cement.

The pebbles used should be tough, hard and not easily split or chipped.

Well rounded pebbles of flint, quartzite and granite, measuring about four inches in diameter, are those usually used for the grinding of cement clinker.

Pumice—It is as a polishing material that pumice finds practically all its uses. In the finishing of fine furniture, pianos, carriages, etc., pumice is employed to smooth and polish the varnished surfaces. The finely ground and bolted pumice is generally used for this class of work, though occasionally the lump is used.

For the dressing of lithographic stones a small quantity of lump pumice is used.

In the polishing of pearl and bone buttons, celluloid goods, jewelry and other fine metal work, the powdered material is used. It should be very carefully graded as to size of grains, the grades ranging to an almost impalpable powder.

Pumice powder is used in the polishing of plate glass, following bevelling, etc. Freedom from large particles is essential.

In the manufacturing of scouring soaps, metal polishes, etc., finely ground pumice is used, and small quantities are used in toilet preparations, such as tooth and nail powders.

Pyrite—The main use of pyrite is as a source of sulphur in the manufacturing of sulphuric acid. The mineral is roasted in an oxidizing atmosphere, in specially designed furnaces. The sulphur content burns to sulphur dioxide (SO_2), and the iron to ferric oxide (Fe_2O_3). The gaseous sulphur dioxide is further treated to convert it into the trioxide (SO_3), which on taking up water becomes sulphuric acid (H_2SO_4). The ferric oxide which is the solid product of the roasting process, often spoken of as pyrite residue or cinder, is of the same composition as hematite. It is frequently smelted for its iron content, or, if the original pyrite contained copper, gold or silver values, these metals may be extracted by smelting or some other metallurgical process. The pyrite residue is used also for making paint. It is a brilliant red and makes the pigment known as red oxide or Indian red. The residue from a well roasted pyrite contains about one-half a per cent. of sulphur.

In his report on pyrites, Dr. Wilson states that "pyrites suitable for acid making should contain as much sulphur as possible. . . . . The greater number of acid makers demand a product containing not less than 42 per cent. sulphur; there are, however, a few large consumers who purchase ore as low as 37 per cent. sulphur. Many purchasers demand that the ore be free from arsenic, though in certain fertilizer works, ore otherwise desirable will be accepted if the arsenic content does not exceed one per cent. The presence of copper, zinc and lead, antimony, calcium and magnesium, fluorine, chlorine and selenium are undesirable. Ore containing pyrrhotite as well as pyrite is also undesirable, though it will be purchased by some consumers, if the sulphur content is not too low."

Sulphate of iron or copperas ($FeSO_4$) is manufactured by allowing water to trickle slowly through a bed of finely broken pyrite. In the presence of the water oxidation takes place, producing sulphate of iron, which is taken into solution by the water. By evaporating the water the sulphate of iron is obtained in crystalline form.

Pyrite is used in the manufacturing of sulphite pulp from wood. The pyrite is roasted in the same manner as for sulphuric acid making, except that care is taken not to admit an excess of oxygen to the roasting furnace. The sulphur dioxide is used in preparing the bisulphite of lime and magnesia as described in the notes on limestone.

Pyrolusite—When manganese dioxide and potassium chlorate are mixed together and heated, oxygen is given off. This is one method adopted for producing oxygen for industrial purposes, but it is being superseded by the electrolytic and liquid air methods.

Pyrolusite is used in the manufacturing of electric dry batteries. It should analyze at least 85 per cent. manganese dioxide and not over one-half of one per cent. ferric oxide.

In the melting of bronzes, manganese dioxide is added to the crucible as a desulphurizer.

As referred to before, pyrolusite is used for counteracting the green color of glass due to silicate of iron, introduced by impurities. Manganese dioxide when added to the glass mixture gives a purplish tint, this color is complementary to the green and thus destroys it, producing a colorless glass. It is used for the same purpose in porcelain manufacturing and enamelling on sheet metal. For these purposes the mineral should be as free from iron as possible.

Pyrolusite is used extensively in the manufacturing of varnish. It acts as a drier. For this use it should be high grade, very finely ground, and free from siliceous impurities.

Sand—Smelting. In the smelting of some ores containing basic gangue, quartz is introduced into the furnace charge as a flux. The quartz used for this purpose may be vein quartz, quartzite or sandstone. If it contains metallic values, it should be classed as an ore having desirable properties for mixing purposes; but if it is barren it must be considered merely as a flux. The quartz is delivered to the smelter as it comes from the quarry, or it may be crushed to any specified degree of fineness.

Crushed quartz is used as a material for lining certain metallurgical furnaces.

Foundries—A moulding sand should be of fairly uniform fineness and contain sufficient clay to give it body and strength to withstand the withdrawal of the patterns, the handling of the moulds and the action of the molten metal. It should be sufficiently porous to allow the escape of the gases developed by the hot metal. It should be refractory, otherwise it would sinter, closing up its pores and thus preventing the escape of gases, as well as fusing to the surface of the metal causing ugly castings which would not machine easily. The presence of lime is objectionable, as it tends to lessen the refractoriness and also gives off gas when brought into contact with the hot metal. Undecomposed feldspar also lessens the refractoriness, due largely to the contained alkalies. For heavy work a coarse, very porous and highly refractory sand is required, while for light castings of iron and for brass a finer sand is necessary.

The life of a moulding sand depends largely on the properties of the bonding material. When the bonding material is a good refractory clay, the sand may be used over and over again. If the clay loses its plasticity on heating, the sand deteriorates rapidly in use.

In order to determine the suitability of a sand for foundry purposes it is necessary to subject it to physical tests and finally to a test in actual foundry service. An ultimate chemical analysis is useful, inasmuch as it indicates the presence or absence of ingredients which would tend to lessen the refractoriness, but so far as alumina is concerned, the percentage is of doubtful value in determining the worth of the sand. The alumina is derived, not alone from the clay matter, but

from the undecomposed feldspar, of which there may be a considerable quantity in the sand. Therefore the percentage of total alumina is not indicative of the proportion of clay matter to sand grains.

In general, a good moulding sand is one consisting of angular, or sharp grains of quartz (small quantities of other minerals are always present) which are covered with a thin film of clay. The clay should not be in excess of the quantity necessary to produce a firm bond between the particles of sand when rammed in a mould. The clay should be plastic and refractory.

Large quantities of river, or sharp bank sand, are used in the making of cores for foundry moulds. It is the general practice to use available local sands for this purpose, without much regard for their suitability.

A core sand should be clean and made up of grains of suitable size for the work in hand. As in the case of moulding sands, a coarse grade should be used for heavy iron castings and a fine grade for light iron and brass castings. Especially for heavy iron castings, a sand should be selected which does not contain a large percentage of readily fusible or fluxing impurities, such as feldspar, lime and iron oxide. A sharp sand is more desirable than one made up of rounded grains, for it bonds better and makes a stronger core.

For the casting of steel very refractory sands must be used for the making of moulds and cores. Very sharp sand of at least 95 per cent. silica is usually specified. It must be free from fluxing impurities. In order to have a porous mould and yet give a smooth finish to the surface of the steel casting, a coarse sand is used to form the bulk of the mould, but a thin layer of very fine sand or ground quartz is placed in that part of the mould which will come in contact with the metal. This ground quartz is known as silica flour. It varies in fineness from 80 mesh to 150 mesh.

Fire sand is a highly refractory sand, 92 per cent. silica or over, used in bedding the floors of re-heating furnaces and gas-fired forges.

The cleaning of castings is frequently accomplished by means of a sand blast. A fairly coarse sharp sand is used for removing the attached sand, while for cutting out cores from hollow castings a much coarser, but not necessarily sharp sand is used. The more quartz there is in the sand the longer will be its life.

Ceramic industry—In the manufacturing of porcelain, enamel ware and enamelled bricks, finely ground quartz is extensively used.

In the manufacturing of porcelain, finely ground quartz, feldspar and clay are mixed together to form the body of the ware. (In the trade the term flint is applied to the quartz used in this industry. True flint is very little used on this side of the Atlantic.) In many glazes for porcelain quartz enters into the mixture.

The mixture used in enamelling metal ware and bricks is made up of a number of chemicals and minerals, one of which is quartz.

The quartz used for enamelware and porcelain should be finely ground, and should be as free as possible from impurities which would tend to produce "off-color" in the finished product. Iron oxide should not be in excess of one-half of one per cent.

Great care must be exercised in the grinding of the quartz, that little iron be introduced into it by abrasion from the machine through which it passes. It is usually ground to about 120 mesh.

Glass—Glass sand, the principal constituent of glass, is crushed sandstone, or a natural sand containing a very high percentage of quartz particles. As glass sand does not command a high price, it seldom pays to crush quartz or quartzite for this purpose. Owing to the hardness of these, there would be danger of introducing an undue amount of iron during the crushing, if ordinary methods were adopted.

As stated above, the usual material used is a natural, high silica sand, or a friable, easily crushed sandstone.

Glass sand should be very low in iron oxide, not exceeding one-half of one per cent. for white flint glass. It should be free from clay, feldspar and mica except in very small proportions. The sand should be of medium fineness, that is, between 20 mesh and 50 mesh, and should be fairly uniform in grain size. Sharp sand is preferred to that made up of rounded grains.

Sand-lime brick—The strength of sand-lime brick depends upon a firm bonding of the sand grains through the agency of lime. A mixture of sand and lime is pressed into bricks, which are then subjected to the action of steam under pressure, for several hours. A chemical union takes place between the lime and the quartz of the sand, forming hydrated calcium silicate. The sand used should not be too coarse. That passing through a twenty mesh screen and composed of grains ranging in size down to minute particles is desirable. In other words, the sand grains should be so graded in size as to leave very little interstitial space. The strongest bricks are made from sharp sand, which is free from inert minerals, such as clay, iron oxide, mica, etc. The clay and iron oxide are particularly objectionable, since they are liable to mask the grains of quartz and thus prevent the union of the lime and quartz. Ten per cent. of clay substance should be set as the extreme limit. Feldspar is less objectionable, but in large proportions is undesirable as it reduces the strength of the brick.

Artificial stone—In the making of artificial stone, common sharp sand is used in the mixture for the body of the stone and a white silica sand or crushed quartz for the face. The silica sand or quartz should be about 20 mesh size.

Building and concrete purposes generally—Sand for these purposes should be sharp and free from clay matter, vegetable matter, etc.

Paint manufacture—Finely ground quartz (silex) is used as a base for the making of wood fillers. To some extent, this same material is used as an "extender" in mixed paints. It is claimed to improve paint for outside service.

Abrasives and polishes—Owing to its hardness and the sharpness of the fragments, crushed and ground quartz is valuable as an abrasive and polishing material.

Ground quartz carefully graded as to size is used in making sandpaper and for sanding "sand belts" for wood working. Very finely ground quartz is used for polishing pearl and bone buttons, and for the making of metal polishes and scouring soaps.

Sharp river sand and silica sand are used for grinding and beveling plate glass and for "frosting" it by means of the sand blast.

Rubber goods—Finely ground quartz is used to some extent as a loader for rubber goods.

Matches—In the manufacturing of matches very finely ground quartz enters into the composition of the match head. A coarser grade of quartz is used for preparing the sanded surface of the box on which the match is ignited.

Sweeping compound—Clean river sand is employed in large quantities in the making of so-called "sweeping compound."

Fused quartz—Special chemical and physical apparatus is made from quartz by fusing it in an electric furnace and casting or pressing it into shape. Such apparatus is unaffected by sudden extreme changes of temperature and is not attacked by the common acids. There is no manufacturer of such goods in Canada.

Filter plants—Sand is used as a filtering medium for water. The following specification, furnished by Mr. Rust, late city engineer of Toronto, is that which was used in that city in the construction of their filtration plant. "The filter sand shall be clean sand, with either sharp or rounded grains. It shall be entirely free from clay, dust or organic impurities and shall, if necessary, be washed to remove such materials from it. The grains shall all of them be hard material which will not disintegrate. The effective size shall not be less than 0.25 millimeter nor more than 0.35 millimeter. The uniformity co-efficient shall not be more than 3.0. The sand shall be free from dust and shall not contain more than one per cent. finer than 0.13 millimeter, and shall be entirely free from particles over five millimeters in diameter. In all other respects the sand shall be of a quality satisfactory to the engineer."

Salt—The following is a list of the principal uses of salt in the Canadian industries, arranged roughly in order of the amount of salt consumed—preserving meats, fish, butter and hides; making hydrochloric acid and other chemical compounds of either sodium or chlorine; in soap making; glazing drain tile, etc., refrigeration; and in certain metallurgical processes.

Shale and Slate—Soft shales are frequently ground and used for brick making. Large quantities are used in a number of localities in Canada for this purpose. No record of quantities is available.

Slate is used as a roofing material. It is split into thin sheets and trimmed to convenient dimensions. There is only a small market in Canada for slate shingles, as they do not withstand the effect of our severe winters satisfactorily. It is also used to make electric switchboards, school slates and blackboards.

Crushed slate or shale is used for making "ready roofing." For this purpose it is crushed to about one-eighth or one-quarter inch size.

When ground very finely these rocks are used as filler for wood. Paint manufacturers prepare wood-filler by mixing the ground material with oil.

Talc—The particular properties of talc which make it useful in the industries are its softness, slipperiness, refractoriness, non-conductivity of heat and electricity, and its resistance to the action of most chemicals.

The principal use of talc in this country is in the making of paper. For this purpose it should be very finely ground, free from grit, and as nearly white as possible for the better grades of book paper. It is used as a filler to be added to the pulp to produce a white, opaque paper and also in the coating of paper. Agalite, on account of its fibrous nature, is the variety most desired by the paper trade because of its greater "retention" and the somewhat stronger paper resulting from its use.

Powdered talc is used in large quantities in the manufacture of talcum powder and other toilet preparations, and also as a filler or loader in the cheaper grades of toilet soap. For toilet powders a very pure grade is employed. It should be white and very free from grit. For soap the color is not so important a matter, but freedom from grit is insisted upon.

For filling and dressing cotton cloth white, grit-free powdered talc is largely used. It is also used in the preparation of cloth for window blinds, and to a lesser extent for other textile purposes.

A low grade of powdered talc is used as a foundry facing. That prepared from the foliated variety is best.

In the manufacturing of rubber goods talc finds two uses. In the preparation of the rubber, talc is added as a filler, for which purpose it should be finely ground and free from grit. It is also used to dress the moulds used in forming the rubber goods to prevent sticking.

Very finely powdered talc is used in the making of enamel and other paints. In most cases pure white stock is specified.

Talc enters into the composition of magnesite flooring. For this the cheap grades are usually employed. Agalite, the fibrous variety, is sometimes specified.

In order to prevent "ready roofing" paper and felts from sticking when rolled for shipment and storage, some manufacturers dust the prepared surface with talc. The lowest grades may be used for this purpose.

Talc is used sometimes in the insulating composition for electric cables.

Among other lesser uses of powdered talc are the following: dressing of fine leathers and kids, as a lubricant and as a powder for gloves and shoes.

In the making of gas burners, slate pencils, tailor's chalk and white pencils, pure grades of massive talc are used. Very little is used in Canada for these purposes.

Such soapstone as is used in Canada is purchased already manufactured into the desired sizes and shapes. Among the many articles which may be made from soapstone are the following: Electric switchboards, laboratory table tops, wash tubs, sanitary fittings, hot plates, griddles, stove linings, furnace linings, acid tanks and lining for causticizing chambers in sulphate pulp mills.

Tripolite—Owing to the finely divided and angular silica, which is the main constituent of tripolite, it is very useful as a polishing material for metal.

In those industries where there is much polishing of metal work large quantities of tripolite are used in the form of grease bricks. Much is imported into the country already manufactured and some manufactured here.

Among other uses of tripolite are the following: As a filler for rubber goods, as a heat insulator for steam pipes, in the paint industry as a wood filler, for making water fillers and as a filling for the walls of safes.

Before the introduction of wood pulp as the absorbent for nitro-glycerine in the manufacturing of dynamite, tripolite was used for that purpose.

HARDY PATENT PICK.

This agency held until recently by Messrs. Mussens Limited of Montreal has now been transferred to Mr. Geo. E. Leighton, with office address 318 St. James Street, Montreal and workshop and warehouse address No. 23 Colborne Street, Montreal, where all classes of the Hardy Patent Pick Co.'s manufactures are kept in stock.

Mr. Leighton will be pleased to receive enquiries for any of the Hardy Company's specialties, such as mining, contractor and agricultural tools and plant, pulverizing or grinding machinery and mills, elevating screening and coal handling plant, hammer and piston rock drills for steam or air, coal cutting machines, Hardy's special rock drill steel, either solid or hollow, etc.

THE EFFECT OF FROST UPON CONCRETE*

By John Hammersley-Heenan, Assoc. M. Inst. C. E.

The engineer who is called upon to carry out work in Canada during the winter finds that the methods of construction which were satisfactory in the summer will need considerable modification to suit winter conditions.

Concrete work, especially the lighter forms of reinforced concrete, used in building construction, needs greater care and supervision. As a result of considerable experience gained during the last few years, it can be said that the freezing of concrete will not damage it if it has first had a chance to set under favorable conditions for about two days. The affect of the freezing is simply to delay the process of hardening, which will again proceed under suitable conditions, and will eventually attain its full strength. If concrete is frozen before it has commenced to set, it will not be injured if precautions are taken to prevent it from freezing again after it thaws until it is sufficiently hardened to withstand the effects of subsequent freezings. It is alternate freezing and thawing during the process of setting that causes the damage.

To meet the foregoing conditions, when carrying out concrete work in winter, it is necessary to devise means of mixing the concrete with materials freed of frost, placing it in the forms before it has commenced to freeze, and then protecting it and keeping it warm for about two days. After that it may be allowed to freeze without fear of its being damaged.

In the case of concrete in mass, of large bulk, it is unnecessary to apply external heat, as the large body of concrete will generate sufficient heat during the process of hardening to enable the mass to set; all that will be necessary is to protect the outside of the concrete so as to keep the heat in. This can be done by covering the concrete with clean straw.

For light sections of concrete, such as in reinforced concrete, poured at a temperature not below 22 deg. Fahr., some engineers allow salt to be used in a proportion not exceeding 10 per cent. There are many arguments for and against its use. The author prefers not to use it, except in marine works, when the concrete is mixed with sea-water and the salt is admitted in that form. He has found that, instead of using salt, good results will be obtained for temperatures that do not fall below 22 deg. Fahr. by heating the water with a steam hose taken from the mixer boiler, and when necessary placing a few coke or wood fires on the heaps of sand and crushed stone, the usual precautions being taken to protect the concrete when in the forms, as described later.

For lower temperatures than those referred to above greater precautions must be taken to heat the ingredients by means of steam coils or radiators.

The concrete having been mixed, and the portion of the work to be carried out decided upon, the floor immediately below it should be partitioned off with tarpaulins, and coke stoves arranged under the floor slab, allowing about one stove to every 800 sq. ft. of floor space. All loose dirt and snow must be removed from the forms with brooms, and a steam hose should be applied to remove all ice and frost, the steam playing continuously over the forms in advance of the concrete, thus warming them in readiness for the concrete. The concrete should be poured quickly and continuously, and as each section is completed a tarpaulin may be drawn over it, supported on wooden strips about 6 in. above the surface of the concrete. In most cases this protection will be sufficient, but during very cold weather it will sometimes be found necessary to form a sort of tent over the floor, in which extra stoves are placed to protect the workmen and the upper surfaces of the concrete.

Great care must be taken to have the fires kept burning continuously for two days, after which the concrete may be allowed to freeze without fear.

The work must be examined from time to time until it is found to be hardened sufficiently. During summer working the author has allowed the supports from the underside of slabs to be removed in four days, but on other occasions four weeks have not been found to be too long.

There are many examples of concrete works which have stood the test of time without showing any signs of being affected by frost; but, on the other hand, a few cases have been reported of very serious corrosion due to the action of frost, such as bridge piers and reinforced concrete piles.

Judging from the information available at present, concrete exposed in air in a dry locality need not be affected by frost any more than good building stone, and probably it will stand much better. Concrete always submerged under water is protected and need cause no anxiety. But concrete alternately wetted and frozen must be protected from frost. On work which is being carried out at Halifax, Mr. John Kennedy, M.Inst.C.E., is protecting the concrete piles between high and low water with a covering of wood about 2 in. in thickness, which it is hoped will prevent the action of frost.

*From a paper read at a meeting of the Institution of Civil Engineers (Great Britain), December 2, 1914.

AYER & LONGYEAR, INC.

Articles of incorporation have been filed with the secretary of the Commonwealth of Massachusetts by the Ayer & Longyear Co., Inc. The principal place of business within the Commonwealth is Boston, and outside the Commonwealth is London, Eng. The purpose of the corporations as stated in the articles, is to buy, lease and operate coal and other mineral properties; to transport coal and other minerals; and to own and operate vessels engaged in such transportation and other business incident thereto. John M. Longyear of Brookline, Mass., and Marquette, Mich., is president; Charles F. Ayer of Boston, treasurer; and Frederic Ayer, Jr., of Topsfield, Mass., clerk. The capitalization of the company is only nominal.

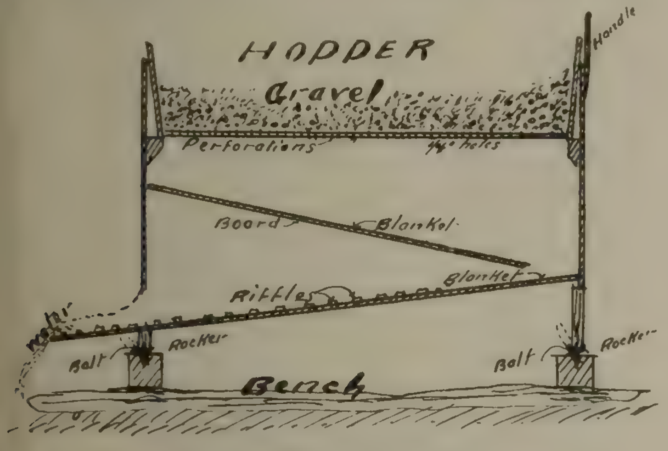
The Ayer & Longyear interests have been associated for nearly half a century in the ownership of vast tracts of land in the northern peninsula of Michigan, covering both the copper and iron mining regions and many of the largest iron mines there have been opened on land bought from these interests or still held in fee by them. They represent the principal ownership, outside of Calumet & Hecla, in the new White Pine mine. Mr. Longyear and associates also own and for several years have been developing, several islands in the Arctic ocean north of Russia containing rich coal deposits. He is one of the largest iron mine operators in Sweden, his properties lying largely in the rich Gellivare district, north of the Arctic circle.

The Michigan Geological Survey has just published a report, by Richard A. Smith, on the occurrence of oil and gas in Michigan.

ROCKER AND GRIZZLY METHODS OF PLACER MINING

By J. A. Macdonald.

It is only within the last ten years that the method of dredging for gold in the Klondyke has been carried on to an appreciable extent. Previous to that time the only methods employed were the sluice box and the rocker, and these are used to a considerable extent at the present time, for dredging requires a lot of money. A medium sized dredge with all appliances for operation costs from eighty to one hundred thousand dollars.



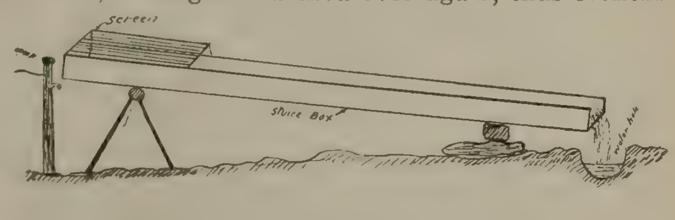
Sectional View of Rocker

In the early days of the Yukon the principal means of separating fine gold from gravel and sand was by the use of the rocker which, as its name implies, is a box some three or more feet long and two feet wide. placed on a pair of rockers after the manner of the old baby-cradle. On the top is a box or hopper, perforated with ¼ in. holes. Where plenty of water could be conveniently taken from a higher to a lower level a series of boxes, made of plank, are elevated on the trestles. Water enters at the high end and flows through them. They are fitted into each other at the joints, so that the stream is continuous through the boxes. They are called "sluice boxes," and are so sloped to allow the water to carry down the gravel and sand, and yet hardly move the gold.

In the methods used for extracting the gold from the gravel gravity is utilized. Gold is nearly twenty times heavier than water. and eight times heavier than rock. Gold is separated from the dirt holding it by the use of an inclined plane, over which a stream of water is made to flow. The gold bearing dirt is shovelled into the fast flowing stream, which carries along the lighter material and leaves the gold behind. To aid in arresting and holding the gold, barriers are placed in the bottom of the box. These are called "riffles." These riffles are now made of angle iron, cut into lengths the width of the sluice box and bolted together at a certain distance from each other. In the early days, however, the riffles were made of bars of wood, generally sections of small trees, cut in even lengths, and held in position by a section of plank nailed to their ends. These wooden riffles, unlike those made of iron, were placed longitudinally with the sluice box instead of transversely. Variations of the sluice box and riffles constitute all the methods of washing gold.

The sluice box requires a stream with a rapid descent. The fall in the box must be about one in four or five feet, so that in thirty feet of box there must be a head of five or more feet. The sluice box enables the operator to work a great deal more dirt than any other system of manual labor. The material is thrown into the head of the line of boxes and the water does the rest.

It is obvious that on a bar or bank mining there would be but few places where the miner could avail himself of the sluice box. In these cases the rocker is used almost universally. The rocker is worked on the principle of the baby-cradle, but it is also worked on the principle of the hand-sieve used in olden times for grain cleaning, and now to be seen in the modern fanning mill. The upper portion of the box, as the illustration shows, is the hopper. This is a box, six inches in depth, made to fit over and into the upper body of the main box. This upper detachable box or hopper has a bottom of heavy wire netting or a thin iron plate perforated with many holes, usually quarter-inch holes. Below the bottom of the hopper are two or three inclined shelves, made of board, as shown in the cut, and these inclined shelves or sieves are covered with pieces of blanket to hold the gold. The lower incline contains riffles, or a combination of blanket and riffles. Two strong rockers are fastened to the bottom of the box, and these rockers being placed on something solid and fastened thereto with a bolt from the centre of each rocker to the bench beneath are oscillated. The operator sets up his machine beside some pool or stream of water, and fills the shallow box, or 'basket,' with fine gravel, rejecting all the coarse parts. With a pail or long-handled dipper he adds water to reduce the gravel to a concrete-like consistency, and at the same time rocks the machine from side to side. The finer and heavier parts of the sand and gravel pass through the holes in the perforated bottom, and fall on to the inclined shelves below, down which they are sluiced by the water, the gold being caught by the wool of the blanket or in the riffles, as the case might be. Where two men were working together, one carries gravel to the hopper or basket, while the other operates the machine simply by the act of rocking and keeping the dirts well soaked with water. Usually the water as it flows off, is caught and used over again, thus econom-



Grizzly

izing the water supply. If much work was being performed the blankets were taken out at intervals, and washed in a tub of water to get the gold out of them, and immediately replaced.

This method, though slow and laborious, was the only available method in many places in the Yukon. Two men working together could easily clean up from two to four cubic yards per day. In the early days of the Klondyke, around '98 and after, it was nothing unusual for two men to clean up one hundred dollars' worth of dust in a day. On the bars of Stewart river

a hundred dollars a day was considered only very good. In numerous cases a half dozen men have succeeded in taking out as much as fifteen to twenty thousand a month by the slow and laborious rocker method.

At the present time the rocker is little used in the working of claims by the miners in the Yukon. Prospectors, however, still continue to use the rocker in trying out prospects. It is the only method open to them to judge the value of a strike. The diminished value of the dirt bars the rocker, as it would not pay

Operating a Rocker

in the working over of poor dirt. With rich gravel panning out ten cents and over, the rocker method gave profitable results, but now when miners are satisfied with two to three cent pans, the sluice box is the only profitable method. With improved hoisting gear very good profits are now made in operating with grizzly and sluice boxes. Where the diggings are good several lines of sluice-boxes are used simultaneously. These are placed in position and the gravel piles over them, and when the operation of separating the gold begins three or more boxes are put into use.

In the new gold diggings on the Saskatchewan river around Edmonton, the rocker and the grizzly are only used. These bars, where the miners work are under water, and it is only in times of low water that they can be worked at all, in early spring, just before the ice breaks up, and in the fall.

MICHIGAN COPPER DEPOSITS.

The recently issued biennial report of R. C. Allen, Director of the Michigan Geological Survey gives a clear and concise account of the work done by the Survey during the two year period ended June 30, 1914. An item from the Director's report on progress that will interest some of the readers of the Canadian Mining Journal is the following.

"Mr. Reginald E. Hore has prepared for publication a monograph on the copper ore deposits of Michigan. This contribution is supplementary to that of Dr. A. C. Lane, whose work on the geology of the Keweenaw series was published in two volumes as Publication No. 6. A great deal has been written about the geology of the Keweenaw series; but relatively little attention has heretofore been devoted to a study of the copper ore deposits. Mr. Hore's work is a valuable contribution to the science of ore deposition, and will be very useful to geologists and others interested in this phase of geology. The manuscript is fully completed and ready for printing."

PYRITIC SMELTING*

Dr. H. Browne—If 35 years ago we had met to discuss the subject that is before us to-night, the criticism that we must all be mad or we would not be here at all would have been perfectly applicable. No group of men would have come together a generation ago to discuss the subject of smelting ores without extraneous fuel, or largely by the oxidation of their own impurities without incurring the imputation of being crazy.

But metallurgy, like all other branches of human industry, progresses by idealism. In every generation there are old men who see visions and young men who dream dreams.

Thirty-five years ago John Hollway conceived the idea that in the Rio Tinto ore the sulphur and iron, if properly oxidized, could be made to produce heat enough to carry on the smelting of the ores. He saw the vision. Twenty-five years ago Mr. Austin, of Montana, took out a patent on a furnace in which to carry out Hollway's ideas. He dreamed the dream.

Twenty years ago a man working in Montana grasped the possibilities of this idea. To him has been given that inexpressible pleasure which comes from realizing the idea and making the concept concrete. Gentlemen, it gives me great pleasure to introduce to you the man who made the ideal real, Robert Sticht, of Tasmania.

Robert C. Sticht, Queenstown, Tasmania.—I find it extremely difficult to act up, in the smallest degree, to the encomium passed upon me by Mr. Browne.

It is true it has been my good fortune to be able to put some sort of method into the "madness" of 25 years ago; but I am not the originator of the idea, nor the only one who has carried it out. Mr. Browne mentioned the originator, who undoubtedly is Mr. Hollway. He also mentioned Mr. Austin, who gave the first instigation to pyrite smelting as now practised. As against both of these men I was fortunate enough to be able to command the necessary natural resources to carry out the idea continuously in a practical way, so as to make it permanently possible.

At the time I left for Tasmania the method had been tried in this country, and it was my good luck to be connected with some of those efforts, and also to become posted on what Mr. Hollway had attempted. Fortified by his reasonings I was able to apply them to the blast-furnace treatment of pyrites, which he had not the opportunity of carrying to success, and to experiment with this method of treatment in two States, Montana and Colorado, in a small way, now and then.

I say "now and then," because, as a rule, the primary conditions were not favorable, and with this process, as with so many other "processes," it is much more difficult to get an ore which suits the "process" than a process which suits the ore. As remarked, the occasions for trying the real thing were few and lasted but a short time each.

Nevertheless, I thus had a certain foreshadowing of what course would ultimately lead to permanent success, gathered at Toston and Boulder, Mont., and Kokomo and Leadville, Colo. So when I got to Mount Lyell I had some idea how to proceed. I also had perhaps the necessary American "cheek" to go there on so small a basis, but I had every reason to believe that the conditions of ore supply, etc., in Tasmania were such as to make this new method particularly applicable there. I knew very little about the inner workings of pyritic smelting, but was one of three or four men in this country who knew how to do it practically—i.e., empirically.

(*Extracts from a discussion at a meeting of the New York Section, American Institute of Mining Engineers, Dec. 2, 1914.)

As time went on, my ideas became concrete, and now we feel we know its real scope and limitations. We know that in some territories it has been tried and abandoned, and in some cases I think more might have been done with it had metallurgical success not been interfered with by economic factors, the mere question of profitableness many times bringing the carrying out of an interesting theoretical idea to an untimely end. How well we all know this!

I understand questions will be asked during the course of this discussion, which has been honored with the title of an "address." I have not written any address, as I am on a vacation trip and do not intend to do any hard work. I have no figures at hand, and I think the general spirit of this meeting makes it unnecessary for me to produce them. It should resolve itself into a conversational discussion of the subject.

To begin: Of course you all know where Tasmania is. It is that little red spot on the map, among the possessions belonging to England, which occupies a southernmost position, immediately below the continent of Australia, and, except in the north, is surrounded by a tremendous amount of ocean in every direction. It is a small island with extensive mineral resources. Generally speaking, they are poor in values—low-grade propositions; but tin, lead, copper, silver and gold, and rarer metals and earths come from there.

On the west coast of that island there is a low but rugged mountain range, and in the center of that there is the orebody to which my attention was called.

I went there in 1895, single-handed; and if there is anything with which I am pleased it is the fact that I went with the knowledge I had picked up, and was given a free hand to put my modicum of experience to the test. Had I not been an American engineer I would not have been given the free scope accorded to me; and, consequently, what I have accomplished in Australia is due to the high regard which the American engineer enjoys all over the world. All the outlying places of the earth show the work of our hands, to the honor of our profession.

In Australia one American metallurgist had already made a signal success. It was H. H. Schlapp, of Broken Hill fame. We knew each other, and his belief in my statements, which to many must have seemed bordering on the impossible, was of service in giving me support. Dr. E. D. Peters had written a report on the property and gone into the question of treatment, but, owing to the novelty of pyritic smelting, both he and Schlapp were naturally inclined to go slow at first and start with the ordinary process. One day, however, I was asked at a directors' meeting, what would I do if the mine were my own. I said, "I would start with pyritic smelting right away!" and the chairman clinched the situation by responding, "Then go ahead your way!"

We started in a wilderness, and got a plant finished, with three furnaces and hot-blast paraphernalia, in a year's time. The transportation of the machinery was very difficult, as there was no railway at first. We had to build that simultaneously and it was completed just in time to settle the transportation difficulty. The latter did not allow us to get in over 150 tons of coke per month, and I knew I could use that up in one week if pyritic smelting would not work.

As remarked, we erected three furnaces. We started the first one June 24, 1896, and gradually enlarged the plant up to six furnaces. Then, not being able to smelt more than 500 tons a day in four out of those six furnaces, we put up a second plant with five more furnaces, so as to smelt 1,000 long tons a day. Nowadays 1,000 tons a day is not much, but this tonnage was a kind of standard at that time, and has so remained in Australia longer than in this country. Tonnages are, of course, on the increase everywhere, but, coming from foreign parts, when one visits your plants and sees 12,000 tons of ore smelted daily in a single one of them, one is simply overwhelmed, and proud of the colleagues who are doing it.

We soon became an important producer of an eminently clean copper. For a number of years it was thought necessary to smelt the ore twice, first into a lower-grade matte and then into converter matte. It was some years, I think something like six years, before we discarded this system of double smelting, and made converter matte out of the ore in one operation. The re-smelting of the matte, so as to enrich it, was an early trick of the pyritic smelters in the United States, to reduce freight and treatment charges on the matte, and was done by them at once. They found the matte much easier to smelt than the ore, and practised this concentration at a time when the big smelters still thought it could not be done.

We also installed hot-blast, and used it constantly on both ore and matte. In fact, in the first few years we could not have smelted properly without it, but finally the discovery that the amount of energy communicated to the reactions in the furnace by that hot blast was very little led to the conclusion that it could be abandoned without fear, and the turning point came when I suggested doubling the amount of blast per furnace by putting on two blowers, in place of one originally provided for each furnace, and using it cold. This brought the work a step nearer to Bessemerizing, which has always been my ideal point of view for the explanation and evaluation of anything connected with pyritic smelting. The pressure went up, so did the grade of the matte, and costs went down considerably. We then had eleven furnaces, and we discarded one plant altogether, once we found that, with an increased amount of air per furnace, we could get the same capacity out of one plant, and we cut the works down to one set of furnaces, five at that time, but now six.

Since then (1902-1903) we have been going the even tenor of our way with but very little metallurgical excitement, though constantly improving both plant and method. I am sorry to say, however, that our most ideal days are behind us. We now use more carbonaceous fuel than we used to and also treat not quite as much pyrites as before—say 850 tons a day, and 450 tons of siliceous ore, making 1,200 to 1,300 long tons a day in between two and three furnaces. We currently blow about 20,000 cu. ft. of air a minute into a furnace. The pressure is great—64 oz., sometimes 65 and 66. This is largely due to the fact that we have progressively increased the height of our column, so that now it is at times nearly 18 ft. high, above the tuyeres.

Mr. Geo. Guess—How long are those furnaces?

Mr. Sticht.—They are 210 in. long and 54 in. wide. We are not in the happy position of being able to utilize a furnace which is very long, as we practically smelt from hand to mouth, and, for instance, would be embarrassed for ore supply over the week ends, and at times of very boisterous weather, when the mine output drops.

The capacity of the works is greater than the capacity of the mines. The latter is decided by special considerations, and a very particular one is the value set for the siliceous ore we mine, and the extent to which it is extracted. There are great low-grade reserves in this mine, but not profitable at present reckoning, other-

wise we would be working 2,000 or 3,000 tons of ore a day.

The orebodies are not large enough for such great undertakings as you have here. I am sorry I cannot tell you about them, as the deposits are most interesting.

I mentioned the siliceous ore. We started without it, and, for a number of years, used barren quartzite and sandstone devoid of all metal values, for a siliceous flux. We had a pure pyrites from the start, free from all deleterious substances, and the gangue matter amounted to 8 per cent. at the time. It has gone up until now it is 12 per cent. or 14 per cent. The quartz we used had no pyrites or other value in it. Although gold is present in some of the siliceous rocks there, we could not use them on account of excessive cost for delivery.

Early in 1903, a neighboring company, known as the North Mount Lyell Co., which had no connection with us, originally, failed. They had been fortunate in the development of a property which was at first hardly more than a wildcat, had erected smelters and built railways, both in imitation of and in opposition to ourselves; and finally had to give up work, after practically spending £800,000 for nothing. In the meantime they had sold us 80,000 tons of their ore, so that we were fully familiar with it. When the amount of their reckoning came they approached us with a proposition to amalgamate, and this was eventually done by the two companies simply coalescing. The works they had erected became superfluous and their mine was taken over by us, their various staffs being paid off. The failure of the North Lyell company was due primarily to professional incapacity, i.e., inability to see that, under the local conditons, it could not possibly pay to treat a siliceous copper ore, of even 10 per cent. copper, and practically devoid of silver and gold values, by ordinary matte smelting, either in blast furnaces or reverberatories, both of which they tried. Nature had meant the two mines to be worked together as they are now being worked, and nature finally had her way. Our company had the stronger gold in nature through possessing the pyrites, which the other company practically lacked. For our part, however, we were willing to amalgamate for the reason that the copper value in our pyrites had very much decreased and was now, for a large part of the body, only 1½ per cent. We had gradually come down from an initial 4½ per cent., through 3½ per cent., to 2½ per cent., or rather 2.35 per cent., which we maintained for some years, and this was also getting scarce. It had always been known that an important portion of the deposit was only ½ per cent. in copper, but this had been regarded as beyond the pale of treatment, though now it is the best we have. The accession of the North Mount Lyell mine came at an opportune moment for both parties, for we have since established its value beyond the dreams of its promoters, and have paid the North Lyell shareholders dividends which they would not have obtained otherwise.

And now it must be remembered that we work these two mutually complementary ores, and only two, that those ores are very pure, that the siliceous ore has free silica in it up to 70 per cent.; that our pyrites is practically free from zinc and lead, and that there is not too much alumina or heavy spar, and that from the metallurgical point of view all conditions are very favorable. Of course we treat small quantities of less easy ores, but they do not affect the average.

We have plenty of water, and quartz, clay, and limestone handy, and a highly specialized staff. So the Mount Lyell company has made its reputation on the strength of those two ores. We have not had any experience in smelting bad ores, or middling bad ores, such as the process has been tried on in this country. We have never had to solve certain problems with which you have been confronted. The only material which is difficult there is middle-class siliceous ores with 45 to 50 per cent. of silica, combined, which are really hydro-mica schists, impregnated with copper pyrites. These run too low in copper value for us, and we cannot do anything profitable with them until the flotation processes are perfected.

It will interest you to know that the superintendence of the smelting operations has always been in the hands of Americans, George F. Beardsley at first, after myself; then A. Lewis Dean, and now Robert P. Roberts. The other officers are all Australians, and a most excellent lot of men also. As is but natural under the circumstances, owing to isolation, etc., the personnel of the staff has not changed greatly since the beginning, and that is true in all ranks of service.

Circumstances have been favorable to our consistently smelting about a 2.25 per cent. copper ore. As remarked, the Mount Lyell pyrites ran that after a short period of higher assay, and now that it has come down to 0.5 per cent., or even only 0.2 per cent., it is being treated together with the North Lyell ore, which as mined assays 6 per cent. We thus still have a 2.15 to 2.25 per cent. average and out of this we produce a 45 to 50 per cent. copper matte, by one smelting, at the rate of over 1,000 tons of ore daily, in an average of a little over two furnaces. Unfortunately for the maintenance of the purely pyrite state of the smelting, i.e., a nearly cokeless smelting, the Mount Lyell ore has got lower in iron and sulphur by a few per cent., and the further fact that its copper value has fallen so considerably makes us give the preference to the North Lyell ore as much as possible. The effect has been that we now use a great deal more coke than we used to. Instead of having 42 to 44 per cent. of iron the Mount Lyell now has only 35 per cent., and the corresponding sulphur, and the conditions are such that one cannot operate with the low coke percentage of the older practice.

At one time the amount of coke on charge went as low as 0.1 per cent. per half year. Now, we use from 3.5 to 5 per cent. and occasionally we exceed that a little. That is simply due to the fact that conditions have altered. The composition of the slag has altered too, though it still forms itself, as before. Instead of running 30 to 32 per cent. in silica, as it used to do in the past, it now goes 36 and 38 per cent. The iron in the slag, instead of being 52 per cent. FeO, is now 45 per cent. FeO. We have always used some lime, and the amount on charge is kept constant, irrespective of the consequent slight variation in the CaO contents of the slag. The alumina is not very abundant, about 7 per cent. in the slag. The copper content of the slag from this high concentration smelting, of 20 into 1, may be a little higher than it would be in the double smelting process, but we have not assured ourselves that it really is.

We have about the usual relation between the copper contents of the slag and the matte, and the average slag assay is from 0.35 to 0.45 per cent. copper, according to the grade of the matte. Our slag stream runs 50 to 60 ft. over forehearths before it is discarded into the drain, where it is washed away, and we catch a little matte in each compartment.

We have never refined our own copper, for the reason that the disposal from Australia was difficult and relatively unprofitable. For many years the blister went to Baltimore, and several of the important questions affecting the sampling of this material were pioneered on our product. The situation at the present time is that since the Mount Morgan company's property in Queensland has developed from a gold mine into a copper mine, and circumstances have obliged them to go into refining on their own account, they have given us better prices than any one in America, so it is not only patriotism, but also business, to send the material to them. Just at present, although the European war is on, our company is running with its accustomed regularity and on full capacity, and the Board thinks we can continue as long as the war may last. The copper goes to England now, whereas before most of it went to France and Germany.

Our labor conditions are unique. You hear much of how bad things are in Australia in that line. Certainly, in some respects, they could not be worse in connection with certain classes of men, such as the wharf laborers, and there are constant strikes in most ranks, but that must be put down to a certain hysteria which is being engendered in the men by the new-born consciousness that they are now playing a part in the affairs of the world at large which was not vouchsafed to their forebears. In Australia, I think, this condition of neurosis will pass away early. As you are aware, the relations between capital and labor are there regulated by some very wise and prudent laws. The principal drawback is that the particular judge of the Supreme Court who handles the arbitration cases is too much of a pure lawyer, and not enough conversant with the peculiarities of the human material he deals with, for his decisions to be wholly satisfactory. We have had very little trouble with our own men. We had one strike over a matter of discipline, but the men went back to work unconditionally as far as this question was concerned, after three months of cessation of work, and we gave them higher wages afterward, without their asking for it.

Outside of us the mainland companies have frequent labor troubles, though much of this is due rather to psychological than to economic causes. As far as Mount Lyell is concerned it must be borne in mind that we are decidedly a "one-mine camp." In addition to the parent mine (Mount Lyell) we also own the North Lyell mine and practically all the other properties in the Lyell district. The importance of our enterprise to the State of Tasmania may be gathered when I say that it is generally held that without us the State would go bankrupt. We have one-third of the mine employees in the State in our employ, and are regarded as a patriarchal kind of concern. Our position makes it both necessary and possible for us to do things not feasible under more circumscribed conditions.

In the case of the fire of October, 1912, in the North Lyell mine, we ran the smelters for over six months with almost no profit for no reason but to keep the men together. It would have been highly imprudent to shut down, as this would have depopulated the district, and the resumption of work would have given us endless trouble and expensive delay.

Relations with the unions are quite amicable, and just as we have not had any very serious trouble with them so far, I do not inticipate any in the future. They are legally responsible the same as the employer, and want it so. This must be remembered, that in those countries all classes are exceedingly law-abiding; this applies to the lowly working man as well as to the highly capitalistic citizen. There is also a reasonable conservative element among the men, which keeps them in check. The word "socialism" is wrongly applied to many things going on in Australia. The men at heart are simple decent fair-minded men, and not adherents of the red flag. They like to have property of their own. There are only 4,000,000 inhabitants of all classes in all Australia, and 1,000,000 in New Zealand, so the population is widely acquainted within itself, like the units of a big city, and it is a fact that they can enact public measures there which could not yet be enacted here. Life is less complex than in the United States, and has an old-world ring about it even in the mining camps. Of course the men have their peculiarities, which are inclined to both amaze and irritate an American, but once understood they are agreeable to handle and most loyal. The nationality of the men is practically all British. Legislation totally forbids the entry of the Asiatic races and the southern European peoples you have here in such masses. There are almost no Italians and but a few Greeks, and not even very many Irish. On the other hand, there are very many Scotch. The Cornishmen, once prominent there, are less so now, and there are no Welshmen of importance anywhere in the smelting line. Scandinavians and Germans are scarce.

I now seem to have traversed a good deal of ground without giving much information. Will not some one kindly ask a question?

George A. Guess, Toronto, Ont., Canada.—The subject of pyritic smelting has interested me for some time. I have been engaged in the work for about eight years.

The information we have had in America regarding Mount Lyell practice has been rather meagre. We knew a few of the basic facts, we knew of the 100 per cent. oxygen efficiency, and that a very low coke ratio was used. In American practice there did not appear to be anything like the practice in vogue at Mount Lyell. All the American plants doing pyritic smelting have had to use more coke, and it has been very interesting to learn to-night that the higher coke now in use at Mount Lyell has been a result of treating less pure ores, due to the exhaustion of the deposits of heavy iron pyrites, and that present practice at Mount Lyell is now more like the work in America.

The amount of oxygen in pyritic furnace gases was a subject of my attention while with the Tennessee Copper Co. There you know there is an acid plant. The Tennessee furnace gases contain oxygen. Some recent pyritic work I have been doing gave opportunity to again check the oxygen efficiency. Although we did not sample the furnace gases in this case, the blowers were new, we knew what volumes of air they delivered, and, correcting for temperature and barometric pressure, an accurate calculation was possible. We were smelting an ore containing practically no sulphides but iron pyrites containing copper. There was little or no pyrrhotite. About 87.5 per cent. oxygen efficiency, I figured, was the result in this test; which extended over a period of 6 days when everything was running normally. Our furnaces at Tennessee, as you may know, were at one time dampened back so much in order to get a pressure on the gases going to the acid plant, that no false air could get to the furnace gases. This gave opportunity to sample the gases, which we sampled for SO_2 every 15 min. At stated periods we examined for oxygen. We noted that when a charge containing a high amount of sulphur as pyrites was dumped into the furnace the SO_2 immediately went up. Now I cannot see how the SO_2 content could go up unless there

were free oxygen in the upper shaft of the furnace. If no SO_2 were formed until the focus of the furnace was reached we would never have that rise immediately after the charge was dumped in. So in my experience I have never found a 100 per cent. oxygen efficiency.

It is interesting to hear this evening that Mr. Sticht has had these gas analyses repeated recently, and that the results have practically checked up the original finding. It is probable that his high oxygen efficiency is due to the high ore column which he carries.

Anyox is the latest addition to pyritic plants in America, and is already no infant. It will be one of the big smelting plants in America.

The furnaces are 30 ft. long. They were 50 in. wide at the tuyeres, and had a uniform bosh from the sole plate to the feed floor. That was changed, the upper tier of jackets being set vertically 6 ft. apart. The lower jackets were moved out, so that the furnaces are now 52 in.

There seem to be no contractions in the pyritic charge until it reaches the focus of the furnace; and I see no reason why there should be a bosh in the jacket until somewhere near the focal point.

The System of Charging.—I believe that Mr. Sticht has a much better system of charging a furnace than is practised in America if we except the little plant at Ducktown where the Freeland charging machine is used, which gives an ideal charge. The charge cannot go in in the careless manner used in the ordinary copper furnaces. If that careless manner is used it will form crusts and more crusts. I think we will have to pay more attention in this country to the charging of pyritic furnaces, particularly in order to get long campaigns and better running.

The Anyox Ores.—The mixture of the two ores contains nearly enough silica to flux the ores. When that mixture is being smelted there is not much latitude in the charge. If one has a clean pyrite, with a low silica, and uses clean siliceous material, clean quartz, there is better control over operations. One has cleaner material and less endothermic reaction in his furnaces, with a hotter focus, resulting in a better slag. When the silica is combined with alumina, and the alumina in the ore runs up to 7 per cent. or better, and there is a good deal of schist, and the charge does not allow very much clean quartz, the range of operations is restricted, and the furnaces have difficulty in smelting and are likely to get into trouble.

The Anyox ores may give difficulty in their high alumina content; but so far 8 per cent. alumina in the slag does not give trouble. We ran several days with 8 per cent., or higher, but we have never gone to 9 per cent. I do not know how that would be.

Coke consumption is about 5 per cent. on the ore.

I would like to ask this question, Mr. Sticht: You were using 20,000 cu. ft. per furnace, per minute in a 17½ ft. furnace; did you run with constant speed or constant pressure?

Mr. Sticht—The pressure varies. We run with practically constant speed.

Mr. Guess—I think the constant speed is better.

Mr. Sticht—You can force the 20,000 cu. ft. up one blow hole, and in that case your pressure would go down. Now, it is more to the point to count the revolutions of the blowing engine, in other words, its delivery.

Mr. Guess—If your pressure went from 55 to 65 or 70 oz., what would that indicate in your furnace?

Mr. Sticht—That it is too tight.

Mr. Guess—How do you correct that?

Mr. Sticht—We would consider something ominous was about to take place if we kept on, but it would only amount to an eventual automatic stoppage of the furnace after slowing up, accompanied by an excessively high matte, up to 60 or even 70 per cent. in copper. But we would not try to loosen up the furnace with slag charges, as this would only be a way for wasting coke. We would run to the bin with the coarse ore.

Mr. Guess—You think it is due to fines?

Mr. Sticht.—Yes.

Mr. Guess—Would you have 25 per cent. of fines in your total charge?

Mr. Sticht—Oh, no; that is a great deal.

Mr. Guess—What would it be?

Mr. Sticht—Say perhaps 10 per cent. This difficulty has never troubled us. If one portion of the bin gets very fine, we go to another bin with coarse ore and equalize it. It is only the pyrites that sometimes gets fine, and some of the schisty North Lyell ore, and if the furnaces want a little nursing we nurse them. Fine schisty ore gives more trouble than fine pyrites.

Mr. Guess—Most people that run blast furnaces like to have their charge as free from fines as possible, and I thought they were particularly disadvantageous in the pyritic furnace at Anyox. This fall the crushing plant broke down, and the ore was bulldozed. We had a "dynamite rock breaker." Steel rails were set with openings of 13 in., and the rock was dumped on those and broken through with powder. The men did not break the rock smaller than necessary to get it through, and we had pieces go to the furnaces as large as a suit case.

The ore was unscreened, and we had 20 to 30 per cent. fines. It was a case also where there was 5 per cent. moisture in the ore. It was a rather undesirable mixture to smelt. The stuff smelts all right.

We were running with constant air pressure, 1,000 ft. of air per foot of furnace length per minute. The pressure would be from 36 to 44 or 45 oz. Our slag was 37 per cent. silica; 42 or 43 per cent. FeO; 6 per cent. of lime, and 7½ per cent. of alumina.

Mr. Lloyd—Below what point did you call your ore fines?

Mr. Guess—One-half inch.

H. A. Prosser—Does the furnace run better after or before you put in these large lumps?

Mr. Guess—I do not think large lumps of ore are an objection. As a matter of fact, we were getting the furnaces straightened around to run, and the crusher broke down while that was in progress, so I do not know that these large pieces are not helpful to the furnaces.

The method of charging can be improved upon. It was not possible to place the charge as well as it can be placed, and a crust was formed along the jackets, and as the crust built out the large pieces sometimes could not pass and formed a bridge. When that happened there was trouble.

Mr. Lloyd—I asked a question with regard to the fine ore. The expression has been used many times, and I asked Mr. Guess what he called fine ore, and got the answer from him "below ½ in." This question has been discussed by many people; it has struck me that the name "coarse ore" or "fine ore" depends on how the ore acts under heat. I have had cases where ½ in. ore would be beautifully coarse ore; and again I have had cases where larger than ½ in. ore would be called "fine ore."

What I want to say is that the sulphides act differently in different cases according to how they are con-

structed or crystallized—the roughly granular stuff will break down quicker than finely crystallized stuff. And if the ore did not break down under heat, and was not fine, one would not use such large chunks. In other places by decrepitation coarse ore might become fines and the fines still finer.

Mr. Guess—Speaking in reply to that, Mr. Lloyd, I remember I wanted more iron one time, and I got a shipment of heavy iron sulphides—iron pyrites that contained low silica. It was all 3 in. stuff. When it was put into the furnace there were explosions that were like musketry shooting all over the place. The result of the rapid decrepitation was that the ore went into pyrites sand and ran the furnace pressure up. Decrepitating ores have no place in a blast furnace.

J. B. F. Herreshoff—I saw the work at Anyox, before Mr. Guess went up. I asked Mr. Guess what he did, when he came back from his trip. He said: "I cannot say that I did very much, the ore was suited to pyritic smelting;" but I think he did make some changes up there which were vast and efficient.

But Mr. Guess will not object if I say that before he went up they were pouring the converter slag into the receptacle. Mr. Guess had some of the slag chilled, and put back into the furnaces. He paid particular attention to the charging of the furnace, and found the fine material in the ore bothered by improper distribution in the furnaces.

When I was at Anyox the difficulty was with the furnaces. The blowers gave 15,000 cu. ft. of air to the furnaces, and the pressure was about 48 oz.; when the furnaces ran at high tonnages, the pressures dropped to 36 in.. and they got 30,000 cu. ft. through.

PRECIPITATING SMOKE

Owing to the conservation movement in the United States and to the agitation of farmers against the smelter smoke nuisance, an efficient process of electrical precipitation has been developed. The comparatively small cost of the installation, and the small amount of electric energy necessary for its operation, put it within the reach of almost any plant where its installation is desired or where a nuisance exists.

The process is used for removing either solid or liquid particles carried in suspension in air or other gases. This is done by submitting the gases and suspended particles to the action of a strong electric field maintained between so-called "collecting electrodes" and "discharge electrodes," the latter being insulated from the former and connected to a suitable source of high electric potential. To keep the current flowing between the electrodes through the gases, unindirectional direct current is used. The gases passing between the electrodes become ionized and the suspended particles are removed by the forces acting between the electrodes.

The process has been used successfully for precipitating smoke, cement dust, fumes from acid plants, chlorine gas from electro-chemical plants, zinc oxide from roasting mills, tar from illuminating gas, and fumes and dust from smelters and many other industries.

It is not improbable that this process could be successfully used for collecting the "mist" from sulphite pulp plants and for overcoming the round-house smoke nuisance.

As an example of the power used, one plant treats 30,000 cubic ft. of gas per minute with a power consumption of from 3 to 5 kws., voltage 50,000.—W. J. D.

MUSSENS LIMITED.

Mussens Limited (in liquidation) has sent out the following circular letter:—

We have much pleasure in notifying you that Mr. John J. Robson, Chartered Accountant, of Montreal, who was recently appointed Provisional Liquidator, has, by order of the Court been appointed Permanent Liquidator to this Company. The Court has also granted our application to be allowed to continue the business for a period of six months.

We take this opportunity of notifying you of these facts and advising you that we feel able to demonstrate to our creditors that we will succeed in the efforts which will be put forward to reduce our stock, collect our open accounts and materially reduce overhead charges, with a view to getting into a position to reorganize and continue in business.

While we are in Liquidation, we are carrying on an active campaign for business, and we trust that we may continue to receive your support. We have a good connection throughout the country and all purchases made by us from now on will be paid for by the Liquidator.

Operating as we are, under the most strenuous conditions which have ever existed in Canada, we know that it will take some time to achieve the result at which we are aiming, but if we continue to receive the support of our principals as in the past, we are satisfied we can show good results and ultimately re-establish this business on its old footing.

Since the Liquidation proceedings were put into effect, we have been flooded with letters from manufacturers, as well as from our customers, extending their hearty support and assuring us of their continued patronage. We, therefore, take this opportunity of thanking our friends for this evidence of confidence in us and in our ability to win out.

We also desire to impress upon our customers the fact that we are carrying on "business as usual," and that, although we were always pleased to receive their orders, we are now more anxious than ever to be favored with same.

We conclude by asking our principals to continue the support which has been so freely given us in the past, and we ask our customers to give us an opportunity of supplying them with any material which they may require. All inquiries will be promptly attended to and orders will be filled without delay.

BOOK REVIEW.

MINING WORLD INDEX OF CURRENT LITERATURE—Vol. VI., last half year 1914—By Geo. E. Sisley, Associate Editor Mining and Engineering World—Published by Mining World Co., Chicago—Price $2.00—For sale by Book Department Canadian Mining Journal.

This excellent index to mining literature differs from previous editions by the inclusion of a brief digest of nearly all entries.

The work of preparing the index is a very laborious one and the publishers deserve the heartiest thanks of those who have occasion to search for information concerning minerals and their treatment.

All articles appearing in periodical magazines published in America, Europe, Africa and Australia on mining engineering, metallurgy, mining geology, mineralogy, etc., are to be found here in classified form. The valuable publications of the world's industries, institutes and affiliated engineering and technical societies are listed, as well as publications of Geological Surveys and Mining Bureaus.

CHEMISTRY OF COKE-OVEN OPERATION

Mr. John W. Lee, chief chemist of the Grassmoor Company, Limited, of Chesterfield, delivered a presidential address to the Yorkshire Junior Gas Association at Leeds University, on Feb. 27. The following summary of his remarks was published in The Iron and Coal Trades Review," March 15:

The battery of by-product coke ovens upon which I have gleaned for my address consists of 110 Otto ovens. Sixty of these are of the waste-heat type, and fifty regenerative ovens. Of the waste-heat ovens 50 are 33 ft. 7 in. long by 6 ft. 10 in. high, and 1 ft. 9 in. wide. The other 10 waste-heat ovens are 33 ft. 7 in. long by 7 ft. 2 in. high by 1 ft. 9 in. wide. The 50 regenerative ovens are 33 ft. 7 in. long by 6 ft. 10 in. high by 1 ft. 9 in. wide. The heating of the waste-heat ovens is done by means of 15 vertical flues, and that of the regenerative ovens by 18 vertical flues.

The weight of stamped wet coal charged per oven will average 8.25 and 9.1 tons in the waste-heat oven and 9.7 tons in the regenerative; and the charge will be burnt off in 34 hours and 36 hours respectively. The total capacity of the ovens is about 550 tons of coal per day. The coal used for coking consists of mixtures of the holing slacks obtained from the Tupton, Dunston (Heathcote), Deep Hard and Blackshale seams. Average analyses of these, before washing, show:

	Tupton.	Dunston.	Deep Hard.	Blackshale.
	p.c.	p.c.	p.c.	p.c.
Moisture	5.52	8.08	5.61	3.93
On dry basis—				
Ash	11.33	16.12	20.70	8.80
Volatile matter	28.84	28.66	26.88	31.64
Fixed carbon	59.83	55.22	52.42	59.66
Chlorides equal to NaCl	0.112	0.023	0.049	0.086

The slacks are washed in a Humboldt washer, and after washing the average of daily analyses over a long period gives: Moisture, 11.31 per cent. On dry basis: Ash, 6.08 per cent.; volatile matter, 34.06 per cent.; fixed carbon, 59.86 per cent. Chlorides equal to NaCl, 0.056 per cent.

Average daily tests show 3.5 per cent. of the coal in the dirt. The coal is charged into the ovens, after stamping, by means of a Buchanan machine, and can also be charged from the top in case of a breakdown of the charging machinery.

Coke.

The coke is discharged from the oven by an electrically driven ram, travelling on wheels (which also carry the stamper box) into a "Goodall" coke quencher. The quencher is driven by a motor. The coke is quenched by passing a "Darby" quenching hood, and finally on the revolving table. After draining, the table is reversed, and the coke passed, by means of a conveyor, over a screen into the railway wagons direct. The "Goodall" quencher is an excellent machine; and by its use the moisture content of the coke can be easily controlled, and the breeze and dust kept down to a low figure.

Using a coal mixture of the following composition: Moisture, 12.99 per cent.; ash, 5.65 per cent.; volatile matter, 30.53 per cent.; fixed carbon, 50.83 per cent., the coke yield was made up of: Large coke, 95.2 per cent.; small coke, 2.0 per cent.; dust—below ½ in., 2.8 per cent., giving an analysis:

	Large coke.	Small coke.	Dust.
	Per cent.	Per cent.	Per cent.
Moisture	1.80	16.97	21.55
Ash	9.45	10.33	12.47
Volatile matter (on drying	0.69	3.27	5.56

The ovens have an ascension pipe of 11 in. diameter.

Tar.

The volatile products pass up the ascension pipe into the hydraulic main, which follows the usual coke oven practice, and is of the "dry" type. The temperature of this main varies from about 110 deg. to 150 deg. C. By circulating tar through the main very little trouble is experienced with pitching-up. Some solid deposit has collected of the following compositions: Ammonium chloride, 48.0 per cent.; tar (ether and benzol extract), 30.8 per cent.; coal dust and free carbon, 21.2 per cent. The tar, after circulation, had a specific gravity of 1,166, and gave on distillation:

	By volume.	By weight.
	Per cent.	Per cent.
Ammoniacal liquor	3.1	1.8
Light oils, up to 170° C.	2.3	1.9
Middle oils, 170° to 270° C.	21.6	31.4
Heavy oils, above 270° C.	10.3	10.6
Pitch	....	53.6
		99.3

Free carbon content, 13.4 per cent.

The collected tar from all points had a specific gravity of 1,164, and gave on distillation:

	By volume.	By weight.
	Per cent.	Per cent.
Ammoniacal liquor	2.1	1.8
Light oils up to 170° C.	2.3	1.9
Middle oils. 170° to 270° C.	29.4	26.5
Heavy oils, above 270° C.	17.8	16.6
Pitch	....	52.6
		99.4

Free carbon content, 11.2 per cent.

Leaving the hydraulic main, the gas enters the "Serpentine"—a series of pipes, 24 in. in diameter and 1,350 ft. in length, set horizontally, which serve as air condensers. The gas leaves here at a temperature of about 65 deg. C., and being divided into two streams, enters a battery of three water coolers, rectangular in section, 5 ft. 4 in. by 7 ft. by 19 ft. high. Leaving the coolers at a temperature of about 18 deg. C., the gas passes through liquor sprays. The sprays were put in to assist the ammonia scrubbers in the removal of ammonia. They have not proved of much use for this purpose, but certainly serve as excellent tar extractors, and therefore indirectly help the scrubbers. After the sprays the two streams of gas join, and pass through two tower scrubbers 8 ft. 3 in. in diameter and 23 ft. high.

A series of tests showing the strength of the ammoniacal liquor collected at each point may be of interest:

	Free NH_3. Per cent.	Fixed NH_3. Per cent.	Total NH_3. Per cent.
Hydraulic main ..	0.102	7.093	7.195
1st coolers	0.382	0.083	0.465
2nd coolers	1.454	0.051	1.505
3rd coolers	4.675	0.085	4.760
Before sprays ..	1.295	0.051	1.346
After sprays	1.303	0.051	1.354
No. 1 scrubber...	0.741	0.034	0.775
No. 2 scrubber...	0.398	0.017	0.415

At the outlet of the ammonia scrubbers, the gas is divided up into two streams again, and each stream passes through two benzol scrubbers, each 8 ft. 3 in. diameter and 56 ft. high, filled with wooden grids. In order to prevent corrosion in the tubes of the benzol stills, it is essential that the gas entering the benzol scrubbers should contain the minimum amount of ammonia. One gramme in 100 cu. ft. should be attained in good working. My plan is to keep a 24 hour test running at the outlet of the benzol scrubbers; and our average over twelve months is 0.07 gramme per 100 cu. ft. (equal to 0.06 lb. of ammonium sulphate per ton of coal (10,000 cu. ft.).

Creosote oil is constantly circulated over the grids in the benzol scrubbers, and absorbs the benzol from the gas. From these scrubbers the gas passes to the ovens, boilers or purifiers.

Ammoniacal Liquor.

The liquor is converted into sulphate of ammonia in a plant of the well-known Wilton make, and calls for no special description. Two stills, each capable of dealing with 80 tons, and one still of 150 tons per 24 hours, two saturators, each of sufficient capacity to produce about 10 tons per diem, and a centrifugal dryer, comprise the plant. Excellent sulphate is produced, of a good color, averaging: Sulphate of ammonia, 96.90 per cent.; chloride, 0.03 per cent.; free acid, 0.48 per cent.; moisture, 2.50 per cent.; insoluble matter, 0.04 per cent. The waste liquor (six tests per day for a year) averages: Free NH_3, 0.0056 per cent.; fixed NH_3, 0.0014 per cent. The "Devil" liquor averages: Free NH_3, 0.0228 per cent.; fixed NH_3, 0.0062 per cent. About 0.9 ton of sulphuric acid and 2.5 cwts. of lime are used per ton of sulphate produced.

Except during a period when the acid supplied contained a large quantity of arsenic, no difficulty has been experienced in producing a salt of good color. The acid should be as free as possible from iron content. A typical acid gave, at 143 deg. Twaddel: Sulphuric acid, by titration, 80.640 per cent.; iron equal to Fe_2O_3, 0.059 per cent. The gases from the saturator, after cooling, pass into the main supplying gas to the ovens and are there burned; the chimney gas averaging 1.4 gramme of SO_3 per 100 cu. ft.

Benzol Products.

The method of extracting the benzol from the gas is as follows: A circulating tank divided into four compartments contains the wash oil. No. 1 contains fresh oil and is filled by gravitation from the railway tanks on the siding adjoining. The wash oil used is coal tar, creosote, and should approximate to the following specifications: Specific gravity, 1.000, distilling not more than 5 per cent. up to 200 deg. C. (bulb in vapor), not less than 90 per cent. up to 300 deg. C. (bulb in vapor), and contain not more than 5 per cent. naphthalene and 1 per cent. water. No. 2 compartment contains benzolized oil, No. 3 partly benzolized oil, and No. 4 debenzolized oil. A battery of seven pumps, running at 40 revolutions per minute off one shaft, is connected to these tanks. By an arrangement of three-way cocks the suction of each pump may be put on any compartment in the circulating oil tank, and the delivery set into compartments Nos. 1, 2 or 3. The oil is pumped from No. 4 compartment on to Nos. 3 and 4 scrubbers, and runs by gravitation back through the scrubbers into No. 3 compartment, is picked up again by Nos. 3 and 4 pumps, and delivered on to scrubbers Nos. 1 and 2, running back into No. 2 compartment. The benzolized oil, containing about 5 per cent. of benzol products, is picked up by pumps Nos. 5 and 6 and delivered into the crude benzol still. This still is divided into three parts—a top box (which serves the three purposes of oil warmer, dephlegmator, and benzol cooler), a dephlegmation suction and a distilling section. The cold benzolized oil enters at the bottom of the top box, and is heated to about 90 deg. C. by the vapors from the dephlegmator passing into the top chamber of the box.

The oil is finally raised to a temperature of about 115 deg. C. by means of indirect steam. The heated oil then enters the top tray of the distilling section of the apparatus, and passes over a series of trays, fitted with hoods. At the bottom of this section dry steam, at a pressure of 100 lbs., is blown in. The action of the steam bubbling through the wash oil liberates the crude benzol, which, together with the steam, passes through the dephlegmation section, through the top box, on to the condenser. At the bottom of the condenser the oil and water are separated. The water, which should not contain more than 0.1 per cent. of NH_3, is delivered into the ammoniacal liquor well. The crude oil goes into the storage tank.

The stripped oil from the crude still passes through seven coolers, each 23 ft. 6 in. long and 9 in. in diameter, with four limbs in each, of the Lucas design, constructed strictly on the counter-current principle. Leaving the coolers at a temperature of about 18 deg. C., it returns to circulation through tank No. 4.

The crude benzol is now distilled at about 200 gallons per hour in the first rectifying still by means of indirect steam at a pressure of not less than 100 lb. to the sq. inch. This still has a capacity of 6,000 gallons, with a trap dephlegmating column, supplemented with a top box through which water can be passed. During distillation the products are separated into crude 90 per cent. benzol, crude 90 per cent. toluol and crude 90 per cent. solvent naphtha. The residue in the still, consisting of light creosote saturated with napthalene, is run into cooling pans. After cooling the creosote is drained off from the naphthalene and returned to circulation through tank No. 4. A typical distillation gave 6,382 gallons into still; 3,863 gallons 90 per cent. crude benzol; 601 gallons 90 per cent. crude toluol; 409 gallons 90 per cent. solvent naphtha; 1,256 gallons of oil returned to circulation. The oil returned to circulation had a specific gravity of 1.015, and on distillation with the thermometer bulb in the vapor showed: First drop, 166 deg. C.; up to 200 deg. C., 14 per cent.; 200 deg. to 270 deg. C., 86 per cent.

The crude products are separately washed in an acid-proof agitator, partially homogen lead lined, of the Lucas design. The working capacity of the washer is 4,000 gallons. The products are first washed with strong sulphuric acid, 168 deg. Twaddel (92 per cent. by titration), to extract all resinous substances dissolved in the crude products. After washing for an hour, the acid residue is run off from the bottom of the washer into acid pots, and the "treacle" boiled up with direct steam. The carbon is solidified, and

the acid, of about 32 deg. Twaddel, containing 18 to 20 per cent of sulphuric acid, is used in the sulphate of ammonia plant. After draining off the acid, the contents of the washer are agitated with caustic soda solution to 40 deg. Twaddel for an hour. After standing, the residual solution of soda, etc., is drained off, and the washed product passed into a second rectifying still, similar in capacity and construction to the first, and is distilled by means of indirect steam. Washed solvent naptha is distilled with indirect and direct steam under vacuum. After washing and distillation, the products obtained are pure 90 per cent. benzol, pure 90 per cent. toluol and pure 90 per cent. solvent naphtha. Each portion, after being condensed, passes into its respective storage tank, and is ready for despatch.

Over a year's working, for each ton of acid used 7,544 gallons of products have been washed, and for each ton of "Kausticine" (90 deg. Twaddel 43.4 per cent. NaHO) 34,214 gallons.

The loss in washing is 5, 6 and 25 per cent. in benzol, toluol and solvent naphtha respectively. The relative qualities of the washed products recovered have been 74 per cent. benzol, 10.8 per cent. toluol, 15.2 per cent. solvent naphtha, and the average quantity 2.5 gallons per ton of dry coal. In use the wash oil thickens, and its efficiency decreases. It is then taken out of circulation, and returned to the distiller. The spent oil has a specific gravity of 1,090, and gives on distillation: Up to 200 deg. C., 11.6 per cent.; 200 deg. to 300 deg. C., 69.4 per cent.; residue, 19.0 per cent. There is used 0.096 gallon of fresh creosote per gallon of washed product recovered while the loss of creosote is 0.044 gallon.

Gas.

Of the gas produced, from 75 to 90 per cent. is required to heat the ovens of the waste-heat type, and 50 to 60 per cent. those of the regenerative type. The rest is used for lighting, heating, in gas engines and for burning under boilers. Under the first three heads about 7,000,000 cu. ft. per day are used. As the gas at the outlet of the benzol scrubbers contains over 900 grains of sulphuretted hydrogen per 100 cu. ft., it is purified by oxide of iron in four purifiers of the Milbourne type, each 20 ft. square by 5 ft. deep. The boxes hold about 30 tons of oxide in two tiers, on ordinary grids. Two classes of oxide—"Lux" and bog —are in use. Laboratory tests of these gave:

	Lux. Per cent.	Bog oxide. Per cent.
Moisture as received	48.26	43.86
On dry basis		
Organic matter and combined water	8.81	32.06
Iron equal to Fe_2O_3	73.59	56.94
Calcium equal to CaO	1.69	1.23
Insoluble matter	9.39	8.68
MgO. alkalies, etc. (by difference)	6.52	0.69
H_2S absorbed—		
On dry basis—		
First fouling	20.6	21.5
Second fouling	19.8	17.4
Third fouling	26.5	14.1
Fourth fouling	20.9	12.3

Working the purifiers on the old system, and without air addition, in practical use the bog oxide picked up sulphur, as follows:

	Moisture. Per cent.	Sulphur. On wet. Per cent.	Sulphur. On dry. Per cent.
First time out	37.83	6.61	10.63
Second time out	27.67	15.74	21.76
Third time out	10.47	36.94	41.26
Fourth time out	2.73	47.52	48.85
Fifth time out	3.58	48.64	50.46
Sixth time out	3.99	55.68	57.99

Working the backward rotation system, and adding 2 to 2.5 per cent. of air, the following result was obtained:

	Moisture. Per cent.	Sulphur. On wet. Per cent.	Sulphur. On dry. Per cent.
First time out	24.33	22.70	30.00
Second time out	13.00	45.92	52.78
Third time out	6.96	60.00	64.49

The amount of gas passed per charge increasing from 9,000,000 cu. ft. to 65,000,000. The average composition of the purified gas is: CO_2, 3.6 per cent.; CnHm, 2.6 per cent.; O, 0.3 per cent.; CO, 7.6 per cent.; H, 50.2 per cent.; CH_4, 30.1 per cent.; N, 5.6 per cent.

The unpurified gas contains cyanogen equal to 1¼ lb. of Na_4 $Fe(Cn)_6$ $10H_2O$ per 10,000 cu. ft. The sulphur content was 25.48 grains per 100 cu. ft., and the calorific value 550 B.T.U. gross (500 net). The bulk of the gas is used in three engines of the Westinghouse vertical tandem type, each having four cranks and eight cylinders, of the dimensions of 15½ in. and 16½ in. by 16 in. stroke. The full load of each engine is 500 b.h.p. at 300 revolutions per minute. The engines are coupled to 350 kw. Westinghouse alternators, generating three-phase current at 440 volts and 50 cycles; direct-coupled exciters being provided. The total load on the connections is about 1,280 h.p., and consists of fans, haulages, rams, quenchers, creepers, conveyors, picking belts, workshops, machinery, etc. The engines, at a load-factor of 59 per cent., use 46 cu. ft. of gas per unit of electricity. The cost per unit including charges for management, running, repairs, purification (not gas), is 0.12d.

Experience has proved that a daily test of the exhaust gases for carbon dioxide, oxygen, and carbon monoxide results in an economical gas consumption. Average of good working results shows: Carbon dioxide, 9.8 per cent.; oxygen, 2.2 per cent.; carbon monoxide, nil.

The steam required for the whole coke oven plant is generated in three Babcock and Wilcox boilers by means of the waste gases from the waste-heat battery. The temperature of the waste-heat flue approximates to 1,000 deg. C. Charts obtained on a thread recorder demonstrate its regularity. On the colliery a saving of many thousands of tons has been obtained by an installation of three CO_2 recorders of the Simmance-Abady type. An increase of CO_2 percentage in the chimney gases from less than 5 to 10 per cent. has been obtained, representing a theoretical saving of 17 per cent.

The chief economic minerals of German East Africa are mica, gold, garnet, coal, iron ore, uranium minerals, copal, trona, and salt. All these exist in such quantity that they are either already worked or will prove worthy of consideration under suitable conditions as regards transport facilities. Mica, gold, and garnet are exported almost wholly to Germany, while most of the copal is exported to Zanzibar and England.

HEDLEY GOLD MINING CO.

The annual report of the Hedley Gold Mining Co., operating in Similkameen district, British Columbia, for the year 1914 shows continued profitable progress and results, as under:

Report of President.—During the past year everything in general, at mine and mill, has gone along very well. The ore bodies being opened in lower levels continue to hold their size and value. Everything seems to indicate a long life for our mine.

Our superintendent, Mr. G. P. Jones, and his assistants are to be commended for doing good and economical work on our new power plant, which should give us surplus power to develop some portions of our property not now being worked. We hope that this new and cheaper power will increase our earnings enough to pay for the new development work planned as just mentioned.

Report of General Superintendent.—During the year 1914 the 40 stamp mill treated 78,494 tons of ore of an average assay value of $10.80, and having a total assay value of $847,349.39.

Extraction showed a recovery of 94.09 per cent. of the assay value of the ore, or a total of $797,340.76. Extraction by concentration was $644,851.58, and by cyanidation $152,489.18.

All the ore treated in 1914 was mined from the Nickel Plate property. Practically all the development work done was in the nature of extensions of drifts, inclines, crosscuts or stopes, and practically all this work was in ore, waste having been encountered only in passing through the Andesite sheets that form the foot and hanging walls of the ore. The boundaries of the big stopes in the upper section have been extended east and west and beyond the lines of payable orebodies as previously estimated. The ore on the east side is still of satisfactory grade and strength, which indicates considerably more ore in that direction. The ore in the old stopes is being left, while the lower levels are being pushed forward into new country. The stopes in No. 5 incline below No. 4 tunnel level have all produced high grade ore, and drill holes from the third level through the footwall indicate another section of payable ore. Assays of the cores taken from these holes give an average value of $20 a ton. This ore will be mined from the second level of the Dickson incline.

The Dickson incline has been extended to 750 ft., and stations have been cut at the 100, 200 and 600 ft. levels. The whole incline has been provided with pockets and all necessary equipment, so that it is in first-class condition for doing good work. Stopes have been opened on the first, second and sixth levels, all in ore of satisfactory grade, with that from the stopes on the sixth level, however, of a rather better grade than that from the others. A 160 ft. raise from the sixth level of the Dickson incline to the fourth level of the No. 5 incline above, has been holed through; two stations have been cut in it and from both of these good ore is being mined as well as from the top of the raise and from the 600 level, there thus being four separate beds or ore which are being mined through this raise into the pockets of the 600 level of the Dickson incline.

The sinking of the Dickson incline has been resumed; this should intersect and open large bodies of payable ore below, the occurrence of these having already been proved by the diamond drill. The indications from this part of the mine, as well as those from the ground northeast from the Dickson incline below No. 4 tunnel, are very promising. From the No. 5 incline, at each of the levels, drifts have been run in this direction, and all have encountered shoots of payable ore

The total amount of new work done during 1914 was not large, which was due primarily to want of power. Fortunately the mine has not suffered as a result, for the ore yielding sections are in first-class condition for mining, and it is not difficult to maintain an output of ore of the present grade.

In the month of December, 1913, the directors authorized the selection of a site on Similkameen river and the submission of proposals for a hydro-electric power system, plans for which were afterward accepted. Construction work on the dam was commenced about January 1, 1914; the whole system was completed and in operation by January 2, 1915. The situation of the dam is on Similkameen river, just below its confluence with Twenty-mile creek. The dam is of the stoplog type; from it the water runs in a flume of 9 x 7 ft inside dimensions for 15,000 ft. to the forebay, from which the turbines are supplied through an 8 ft. steel penstock. The twin turbines, of the Francis type, were manufactured by S. Morgan Smith Co., of York, Pennsylvania; they have a capacity of 2,100 h.p. The 1,250 kw. alternating current generator and all the electric machinery at the power house were supplied by the Canadian Westinghouse Co. The governor was provided by the Lombard Governor Co.

There has also been installed, in addition to the old power house, a new 2,000 ft. compressor, manufactured by the Canadian Ingersoll-Rand Co., and direct-coupled to a Canadian General Electric synchronous motor of 440 h.p. This unit, together with the present compressor, which will also be driven by an electric motor, should supply ample compressed air for the mine and allow a surplus as well. The new plant was started without a hitch and ever since has been operating satisfactorily.

During the year all other departments were brought to their highest efficiency. Special mention may be made of a new tube mill now being put in. There has also been added to the mill equipment a new 24 x 36 Traylor jaw crusher. At the mine all buildings have been rearranged, so as to have the men's sleeping quarters as comfortable as possible. A large building has been erected for a dining room, cook house, wash house, lounge room, etc. There has been installed a complete new fire protection system, with a large tank reservoir for water supply.

Diamond drilling, drifting and stoping indicate that there is at this date as much reserve ore as there was at the corresponding period of last year, and it is of equally good grade. It can be said confidently that the mine never looked better than now, and it has a very promising outlook for the year 1915.

Report of Treasurer.—The net profits for the year 1914 were $388,228.65. The dividends for the year totalled $300,000, or 25 per cent. on the issued capital of the company. The amount of undivided profits after payment of all dividends was, on January 1, 1915, $360,324.88.

The new, all-the-year-round, water power plant was completed. The expenditure on it in 1914 was $178,-980.78, which amount was charged to capital account; adding $13,028.57 expended in 1913, the total cost of the system was $192,009.35, or $7,990.65 less than the original estimate of $200,000.

The cost of the new Traylor crusher, $7,079.54, was

charged to capital account; also the cost of a house built for the mine engineer, $1,979.34. All other expenditures, including extension of the Dickson incline, new mine buildings, and new fire protection system, were charged to operating expenses.

The company, on its formation in 1909, was provided with a cash working capital of $280,000. To this should be added $360,324.88, of undistributed profits. The following sums have been expended since the company was formed and charged to capital account: Additions to mill and plant, $136,352.96; new mineral claims purchased, $145,913.13; new power plant, $192,009.35; total, $474,275.44. This leaves a working capital of $166,049.44, as at January 1, 1915, consisting of cash and accounts receivable.

Although the net profits from operations in 1915 were more than enough to pay dividends equal to those of the years 1912 and 1913 (each of a total of $360,000), the directors deemed it wise to maintain a cash surplus of at least $100,000.

Statement of Operations and Earnings.—This gives details of monthly totals. The year's totals are as follows: Tons of ore milled, 78,494; average assay value, $10.80; total value recovered, $797,340.76; expenditure, $409,122.11; profits (including $6,274,76, interest on company's funds), $388,228.65.

Balance Sheet.—Assets: Original investment (mines, mine buildings, reduction plant, etc.), $920,000. Additional investments: Additions to machinery and plant, etc., as shown above, $474,275.44; cash, $108,715.78; accounts receivable, $57,333.66; total assets, $1,560,324.88. Liabilities: Issued capital stock (authorized, $1,500,000), $1,200,000; surplus at January 1, 1915, $360,324.88; total, $1,560,324.88.

LE ROI NO. 2, LIMITED

The fourteenth annual general meeting of the shareholders of the Le Roi No. 2, Ltd., was held March 17th, at Salisbury House, Londonwall, E. C., Lord Ernest Hamilton (chairman of the company) presiding.

The Chairman said: In dealing with the report and balance sheet for this year, I propose to put before you this afternoon matters of general policy rather than a survey of the details connected with the development and management of the mine. For two years we have paid no dividend. This has been due to two causes. Firstly, to a system of what I may describe as overcaution on the part of the management, who have strongly urged upon us during that period the necessity for getting the development of the mine very conspicuously ahead of its ore production. This is, no doubt, broadly speaking, a very prudent policy, but, if carried to extremes, it is obvious that it results in a highly-developed mine which produces no dividends for the shareholders. In this connection there always is, and always must be, a certain variance of opinion between the managers of a mine and those who are responsible for the payment of dividends to the shareholders. This variance of opinion has, in our case, resulted in several interviews which we have lately had with the firm who manage our property, and I think that, as a result of those interviews, we have come to a perfectly satisfactory understanding with Messrs. Alexander Hill and Stewart. We believe that the condition of the mine is good, and that the prospects for the future are very much better than might be indicated by the paper results of the last two years. I will not say more on this subject, as it has never been part of our programme to hold forth unduly optimistic prospects, which may be upset by the changes and chances of mining. The second cause which I refer to as having interfered with the payment of dividends is the fact that during the past two years we have been forced to make certain money payments, in order to preserve the value of our interest in the Cloncurry property. I am glad to be able to inform you that the point has at length been reached when these disbursements are beginning to come back to us, and I think I may safely say that this investment, extremely troublesome though it has been, will, in the end, show a profit to the company.

The Van-Roi Property.

With regard to our other outside interest—the Van-Roi—I regret that I am not able to be so optimistic. The circumstances in which this property was originally taken up have frequently been gone into at these meetings, and I need not go over the same ground again, beyond reminding you that it was taken up on the very strong recommendation of our managers, who personally inspected the property, and who made such reports on it as seemed to remove all elements of risk from the enterprise. This was done, as you remember, at a moment when the Le Roi No. 2 mine showed signs of giving out, and the idea was that the Van-Roi property would take its place as a provider of dividends. This has, unfortunately, not proved to be the case, and there is no getting away from the fact that the whole undertaking was a very great mistake. The position now is that the Van Roi Co. owes the Le Roi No. 2 a considerbale sum of money, and the usual problem arises as to whether it is worth while to put in more money on the chance of getting back that which is already gone. For the time being the directors have decided that it is not worth while so doing, feeling fairly confident that the opinion of shareholders would be in favor of utilizing Le Roi No. 2 profits for dividends rather than for development of another property, the results of which must, of course, be problematical. I do not wish it to be understood from this that we consider the Van-Roi property to be valueless, because this is very far from being the case. But the great trouble is that it was started with insufficient working capital, and that, in order to give it a fair chance, more money is required than we see our way at the moment to put into it. If any company, however, with a small free working capital, were to take it over from us, the probability is that they would make a very good thing out of it, in view of the fact that in one year the mine made a profit of £30,000, and that it is undoubtedly very far from being exhausted. In the meanwhile, the Van-Roi property is shut down, and all the expenses connected with it have been reduced to an absolute minimum.

Development of the Mines.

Mr. Stewart (of Messrs. Alex Hill and Stewart) gave details of the development of the mines, and stated that, on the whole, the position had been vastly improved by the developments which had taken place in the deep ground, and had given the mines a new lease of life. He emphasized the need of extensive development, and thought an expenditure of £15,000 to £20,000 on development annually was required in the Le Roi No. 2 group of mines to keep them alive permanently.

In the course of the discussion which ensued, Mr. Williams suggested an amalgamation with the Van-Roi Co., seeing that they had a very large amount of money at stake in that concern. This suggestion was opposed

by Mr. Lionel Harris, who regretted that the Le Roi Co. had ever taken an interest in the Van-Roi. He did not think that the Van-Roi would ever be a success, because the grade of the ore was too low.

The Chairman thought that the Le Roi Co. might become the absolute owners of the Van-Roi Co. if that concern were reconstructed with an assessment on the shares of something like 4s. The other shareholders, probably, would not put up their assessment, and the Le Roi would become the absolute owners of the property. He felt that they must come to some finality with regard to that concern. Certain expenses were accumulating, which in the end would fall on the Le Roi, because they had guaranteed the overdraft. In reply to a question, he said that they hoped to be able to pay another dividend before the close of the current year; in fact, they had an assurance from the managers that they should be in a position to pay another 1s.

Van-Roi Mining.

Lord Ernest Hamilton presided at Salisbury House, E.C., at the general meeting of the Van-Roi Mining Co., Ltd., and, in moving the adoption of the report and accounts, said the mine was at the present moment shut down, as they had no more money with which to continue work, and every expense had been cut down to the lowest possible figure compatible with keeping the property alive. The position with regard to the company was rather peculiar, as he believed that practically every shareholder in the company was also a shareholder in the Le Roi No. 2. They had so far been financed by the Le Roi No. 2, but the time had come when that company did not see its way to financing the Van-Roi Co. any further. He thought they must look at the situation from the point of view of Le Roi No. 2 shareholders, and agree that it was better to make a certain loss over the one property rather than dissipate the profits of the other company in pursuing the development of a mine which had so far proved profitless to the shareholders. At the same time, he did not wish it to be considered that they looked upon the property as valueless. They had not the working capital to develop it, but their managers held the very strong opinion, which was shared by the board, that with a few thousand pounds of working capital the property could be made to pay good dividends. With regard to the future he was not in a position to say anything definite. They might be able to sell the property or lease it to another company, and suggestions had also been made with a view to their absorption by the Le Roi No 2.

VIPOND.

At the annual meeting of the Porcupine Vipond Mines, held in New York, total assets as of March 31, were reported at \$41,275, composed of \$15,415 in bullion, \$22,495 in current accounts, and \$3,365 in accounts receivable. President Ward said that all the liabilities of the company, including the bond issue of \$65,000, would be liquidated within six months, but as he personally held \$50.000 of this issue he was willing to place it in trust for a year. The rest of the bondholders would, if they wished, be paid off in the period specified.

Mine Manager Poirier estimated total ore reserves at 48,300 tons, worth approximately \$430,000.

PERSONAL AND GENERAL

Mr. Wm. Cooper, superintendent of the Temiskaming mine, Cobalt, was married last week to Miss Hackett of Toronto.

Mr. J. G. Sipprell has been appointed safety engineer at the Temiskaming mine, Cobalt.

Mr. J. V. N. Dorr has been visiting cyanide plants in Northern Ontario.

Mr. A. A. Hassan is examining manganese deposits in Tennessee, West Virginia and Virginia.

Mr. Geo. Watkin Evans, has just returned to Seattle from a professional visit to Southeastern Alaska.

Mr. J. F. Mitchell-Roberts has resigned his position as chief engineer to the Wilfley Mining Machinery Co., of London, to take up private work. He will be absent from London for about nine months.

Mr. R. E. Hore has returned to Toronto after visiting mines at Porcupine and Cobalt.

Mr. H. H. Lavery is mine surveyor at the Dome mine, Porcupine.

Mr. G. B. Church, formerly chief engineer, Goldfields Consolidated Mines Co. is now on the staff of Dome Mines, Ltd.

Mr. A. Marshall, Chemical Inspector, Indian Ordnance Department, has compiled a new treatise on explosives which will be published by J & A. Churchill.

Michigan College of Mines graduates of New York and vicinity have formed a New York M. C. M. club. W. E. Parnell is president and Jas. S. Dunstan, 42 Broadway, is secretary.

Fraser & Chalmers, of Canada Limited, announce that on account of the necessity for increased space, brought about by their rapidly growing business, on May 1st their Head Office will be transferred to No. 59 Beaver Hall Hill, Montreal.

Mr. D. H. McDougall has been elected President of the Mining Society of Nova Scotia.

Mr. Robert G. Drinnan is now in charge of the Hillcrest Collieries, Alberta, succeeding Mr. John Brown.

Sir Robert Hadfield has been selected by the British Government to have charge of engineering works.

Dr. F. S. Pearson is in Toronto.

Mr. Jos. Leiter of Chicago visited Cobalt and Porcupine mines early in April.

Mr. Leon Charles Thrasher, an American mining engineer on his way to the Broomassie mine, West Africa, was among those lost on the steamer Falaba, which was sunk by a German submarine March 29.

Mr. Ralph Stokes is at the front with the Royal Engineers.

Mr. W. E. Cameron, who until the suspension of operations after the outbreak of war in Europe last summer had charge of the several Slocan properties in Slocan district of British Columbia, that were being worked by the Consolidated Mining and Smelting Co., is now superintendent at the Rambler-Cariboo silver-lead mine in McGuigan basin, which mine was the first in the Slocan district at which important deep-level development work was done.

Mr. Lorne A. Campbell, general manager for the West Kootenay Power and Light Co., and auxiliary organizations that supply electric power to mines and smelting works in West Kootenay and Boundary districts, British Columbia, was recently presented with a handsome sterling silver tray, suitably engraved, as a token of the appreciation of his services as representative in the Provincial Legislature of the constituency of Rossland. The presentation was made by Mr. M. E. Purcell, superintendent of the Consolidated Co.'s Centre Star-War Eagle group of mines at Rossland, on

behalf of the citizens of Rossland. Mr. Campbell has since been unanimously renominated as the Conservative candidate for Rossland constituency at the next Provincial election.

Mr. Roy H. Clarke, of Spokane, Washington, recently examined the Blue Bird mine, in the South Belt of Rossland camp, B.C., preliminary to a proposed resumption of development work and ore production at that property.

Mr. A. W. Davis, formerly on the mining engineering staff of the Consolidated Mining and Smelting Co. in British Columbia, who with seven other engineers left that province early last autumn for active service in Europe, has written to a friend in the West that with the exception of Messrs. Thomas Brown and B. T. O'Grady, who have received commissions as officers in the Imperial Army, the British Columbia party is still intact and is with No. 1 Company, Canadian Engineers, in France. Mr. L. B. Reynolds (B.Sc., McGill, 1903), formerly of Nelson, was at the time Mr. Davis wrote at the company's base in England partially incapacitated by reason of having sprained one of his ankles.

Mr. Geo. H. Dickson, Kingston School of Mining, for a number of years engaged in mining engineering in British Columbia and Alberta, is now with troops in training near Victoria, B.C.

Mr. S. S. Fowler, general manager for the New Canadian Metal Co., owning the Bluebell lead-silver mine at Riondel, Kootenay lake, B.C., has returned home from a visit to Ontario.

Mr. John Hopp, who is the largest hydraulic placer-mine operator in Cariboo district of British Columbia, has returned to the Pacific coast after having been in New York and other eastern cities for three months. He was in Victoria, B.C., on April 1.

Mr. Thomas Kiddie is at Morenci, Arizona, on a visit to his son, Mr. John Kiddie, mine manager there for the Arizona Copper Co.

Mr. Andrew G. Larson, of Vancouver, B.C., has opened a branch office in Spokane, Washington, to the more conveniently attend to mining engineering work he has to do in the Coeur d'Alene district, Idaho, which is within easy reach of Spokane.

Mr. Ernest Levy, representative in British Columbia of Messrs. Hill & Stewart, managers for the Le Roi No. 2, Ltd., operating the Josie group of mines near Rossland, has returned from a visit to England. Mr. Douglas Lay, who was in charge at Rossland during Mr. Levy's absence, plans to do consulting engineering work, with Nelson B.C., as his headquarters.

Mr. R. G. McConnell, Dominion Deputy Minister of Mines, is expected to shortly visit British Columbia.

Mr. Robert E. Palmer, who was at Rossland with Mr. W. A. Carlyle and afterward went to the Rio Tinto mines, Huelva, Spain, when Mr. Carlyle became general manager for the Rio Tinto Co., is reported to now be in that company's London offices, as one of its consulting engineers.

Mr. A. W. McCune, Jr., of Salt Lake City, Utah, is at Ainsworth, B.C., to spend some time on mining properties in that camp in which he and his father are largely interested.

Mr. T. A. Rickard has arrived in San Francisco from England, and is again editor of Mining Press. Mr. H. Foster Bain has gone to London to there assume the editorship of the Mining Magazine.

Mr. J. V. Rittenhouse, of New York, who is interested in mining properties along the line of the Grand Trunk Pacific Railway in British Columbia, is again in that province.

Mr. Milnor Roberts, of Seattle, Washington, dean of the College of Mining, University of Washington, who spent last summer directing prospecting and exploratory work on coal lands on Graham island of the Queen Charlotte group, British Columbia, was recently at Goldfield, Nevada, on professional business.

Mr. M. H. Sullivan, assistant metallurgist at the Consolidated Mining and Smelting Co.'s smeltery at Trail, British Columbia, has been nominated by the Liberals of that constituency as their candidate at the election for the Provincial Legislature expected to take place shortly.

Mr. Oscar V. White, superintendent for the Slocan Star Mines, Ltd., has returned to Sandon, Slocan, from a visit to Spokane, Washington, where his brother, Mr. Byron H. White, has been very ill. It is announced that the Slocan Star concentrating mill, which was closed last summer when the war upset the silver and lead markets, will be put in operation again in April.

The Yukon mounted gun section, known as Boyle's troop, after Mr. J. M. Boyle, of Dawson, Yukon Territory, who is financing it, has been transferred from Vancouver to Victoria, B.C., to join the 2nd Regiment of the Canadian Mounted Rifles, which is expected shortly to be sent to the front. There are 52 men in Boyle's troop, which is commanded by Captain Knott.

SPECIAL CORRESPONDENCE

COBALT, SWASTIKA AND SOUTH LORRAINE

The power situation in Northern Ontario has been of very serious importance; but the situation should be relieved by the middle of this month. The water has not come above the ice yet. Usually April 17 sees the water to rise. This year the season is a little earlier than usual and in a few days all mines and mills should be running with full power.

But there is considerable apprehension as to the future. The position in regard to power has been steadily growing worse every year in spite of the efforts to cope with the situation. This year the company states that, with better storage at Matabitchouan Falls, and an opportunity to raise storage on the Montreal river never afforded to them before, they have no fear that there will again be a shortage, no matter how dry the summer and fall may be. But for the past three months the shutting down of the mills in rotation has lessened the output and raised the cost, when to many mines in the district the cost per ounce is a very serious matter indeed. One company did actually close down until such time as continuous power could be assured them.

Development on the Temiskaming mine still continues to be most satisfactory. The same vein, which has been yielding such rich ore from the drifts and stopes on the Beaver line has now been opened up at the 400 ft. level of the Temiskaming. The vein had already been cut from the Temiskaming shaft on the 530 ft. level, where it showed bonanza ore. On the 400 ft. it is six inches wide of high grade ore, though it is not as spectacular as on the 530 ft. level. As the

crosscut found the ore a good deal further south than on the 530 ft. level, there is a prospect of obtaining a longer ore body than was anticipated between the Beaver line and the Temiskaming crosscut.

Last week two cars of ore were shipped. One of these consisted of thirty tons, running about 6,100 oz. to the ton and being worth to the company approximately \$100,000. The other was of concentrates, but these ran so high that a valuation of no less than \$34,000 was placed on the car.

The Beaver Consolidated Mines, Ltd., has announced an interim dividend of three per cent., payable on April 27th. This is the Beaver's usual rate of dividend. Development on the Beaver mine has been very satisfactory of late. The vein system, which has produced such remarkable ore on the Temiskaming side of the line, was first developed on the Beaver, and it has been opened up here on three levels. It is probably the richest and longest and most consistent ore shoot on any property in the southeastern portion of Coleman township.

Shamrock.—It is understood that there is every prospect that the Shamrock mine will be reopened very shortly. Mr. A. M. Bilsky paid a visit to the Cobalt camp last week and stated that the company was being refinanced with a view to starting operations again. The Shamrock adjoins the Beaver, and a good deal of work was done at the property some years ago by the interests associated with the Nova Scotia Cobalt Mining Company.

Crown Reserve.—Good reports continue to be heard of the Nicaraguan property which the Crown Reserve Mining Company is now sampling. It is stated to be a low grade property, with a million tons of ore in sight, which has not been worked consistently before because of lack of transportation. A railway is now being built within a few miles of the deposit, and it will therefore be possible to cut down costs in this respect.

Trethewey.—There are well established reports that the diamond drilling of the Trethewey on their optioned claims next to the Huronia mine is yielding good results. One hole has been put down 500 ft. and another has been started.

An interesting experiment is being tried by an Ohio firm with pebble mills. They have manufactured small manganese steel balls to replace the pebbles in the tube mills. It is claimed that it will greatly increase the capacity of the mills and that their greater cost is more than offset by their length of service.

PORCUPINE AND KIRKLAND LAKE

Tough-Oakes—Though there has been a scarcity of power in the Kirkland Lake camp, as everywhere else, it has been possible to start the new mill. At first there was so little power available from Charlton that all was required to run the mill at 50 per cent. capacity; but now there are two to three drills operating underground. The mill has already proved to be a metallurgical success, and an extraction of 94 and 95 per cent. has been made from ore running around \$40 a ton. The ore to the mill is coming partly from the stopes and partly from the dump.

Acme.—There was some delay in getting the second twenty stamps of the Acme mill running. The big buckets on the aerial tramway from the shaft to the top of the mill developed a defect which, while it did not prevent entire operation, cut down capacity very largely indeed. There should be no further delay in getting the entire battery running when the balance wheels on the cars are definitely and satisfactorily replaced.

Hollinger mill and mine are now in exactly the reverse position to that they occupitd a year ago. Twelve months ago it was as much as the mine could do to supply the mill with all the ore it required; but the new big plant is now working to such good effect that there is already 80,000 tons of rock broken in the mine ahead of the mill, and it is gaining very rapidly, so that mill extension of the Hollinger itself cannot be very long delayed.

Imperial.—Some machinery is being taken into the Porcupine Imperial before the snow goes; but there is little probability that work will start at the property for a month or two. There is also a report that work is to commence on the Apex, which is in the same section of the gold field, adjoining the Dome Lake.

McIntyre.—At the McIntyre the diamond drill operating from the 400 ft. level has struck another vein. It is seven ft. wide, as the core shows it and the assay gave \$12.80 to the ton. While there is no certainty that the drill core gives a correct idea of vein values, as a general rule in the Porcupine camp the values as actually shown in the drift are higher than would be indicated by the core. On the No. 5 vein there has now been opened up 200 ft. of an ore body, which will average 18 ft. wide.

The Porcupine Pet has closed down and the company has made a voluntary assignment. The company has been operating a small five stamp mill for the past year.

Power.—All the mines in camp are still running only 50 per cent. of the time. A foot of snow fell last week and there has been very warm weather since, so that it should not be long before there is relief. The dam which the power company has built across the Mattagami river was completed last fall, too late to secure any storage. The power company believes that with this means of regulating the flow it will be possible to meet all demands for power for some time to come; but so rapidly is the demand growing that this opinion is not generally shared by the mining companies themselves. However, there is little doubt that it will tide over the next year.

Vipond.—There was delay in shipping the 6 ft. ball mill to the Vipond and it had not arrived at the end of the second week in April. Consequently the increase in production of the mill has been delayed. This is the less to be regretted in as much as power is still short and no work is being done at present on the 300 ft. level at all.

Dome.—The production of the Dome for the month of March will run \$95,000. The grade is approximately the same as for the previous two or three months, \$4.14 a ton. Since the issuance of the last annual report, costs have been cut down \$1.25 a ton. This has been effected by an all round reduction in mine, mill and general expenses. In transportation perhaps there has been a larger cut than in any other department. The big ore cars are now in use, and in consequence it has been possible to cut down from two shifts to one shift and still handle more ore than previously. A Buchanan Blake crusher is to be installed at the 500 ft. level for primary crushing. The ore is to be hauled to the shaft by electric locomotives and raised to the surface from the ore pocket.

MARKETS

TORONTO MARKETS.

April 8—(Quotations from Canada Metal Co., Toronto).
- Spelter, 13 cents per lb.
- Lead, 5½ cents per lb.
- Tin, 56 cents per lb.
- Antimony, 25 cents per lb.
- Copper casting, 17 cents per lb.
- Electrolytic, 17 cents per lb.
- Ingot brass, yellow, 10c.; red, 12 cents per lb.

April 8.—(Quotations from Elias Rogers Co., Toronto).
- Coal, anthracite, $8.00 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

April 6—Connellsville coke, (f.o.b. ovens).
- Furnace coke, prompt, $1.50 to $1.60 per ton.
- Foundry coke, prompt, $2.00 to $2.50 per ton.

April 6—Tin, straits, 47.50 cents.
- Copper, Prime Lake, 16.50 cents.
- Electrolytic copper, 15.80 cents.
- Copper wire, 17.00 cents.
- Lead, 4.12½ to 4.15 cents.
- Spelter, 9.50 cents.
- Sheet zinc (f.o.b. smelter), 13.50 cents.
- Antimony, Cookson's, 30.00 cents.
- Aluminum, 18.75 cents.
- Nickel, 42.00 to 45.00 cents.
- Platinum, soft, $41.00 per ounce.
- Platinum, hard, 10 per cent., $44.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $67.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
March—		
23	50⅜	23 5/16
24	50⅜	23 3/16
25	50½	23 13/16
26	50½	23¾
27	49½	23⅜
29	50⅛	23⅝
30	50⅜	23¾
31	49⅞	23½
April—		
1	50	23 9/16
3	49⅞	Holiday
5	50	23 9/16
6	50¼	23 11/16

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.).

April 8, 1915.

New York Curb.

	Bid.	Ask.
American Marconi	.02½	.02¾
Alaska Gold	.35¼	.35¾
British Copper	.00⅝	.01
Braden Copper	.08⅛	.08¼
Chino Copper	.39¾	.40½
Giroux Copper	.00½	.01
Green Can.	.29	.30
Granby	.73	.74
Miami Copper	.24	.25
Nevada Copper	.13	.13¾
Ohio Oil	141.00	143.00
Ray Cons. Copper	.20⅞	.21¼
Standard Oil of N. Y.	185.00	187.00
Standard Oil of N. J.	395.00	397.00
Standard Oil (old)	1290.00	.....
Standard Oil (subs)	890.00	.....
Tonopah Mining	.07¼	.07½
Tonopah Belmont	.45	.45¾
Tonopah Merger	.29	.30
Inspiration Copper	.28½	.28⅝
Goldfield Cons.	.01½	.01⅝
Yukon Gold	.02⅝	.02⅞

Porcupine Stocks.

	Bid.	Ask.
Apex	.02⅞	.03
Dome Extension	.10½	.10¾
Dome Lake	.23¼	.23½
Dome Mines	12.15	12.50
Foley O'Brien	.25	.30
Hollinger	23.75	24.25
Jupiter	.12	.12½
McIntyre	.40	.40½
Pearl Lake	.01	.02
Plenaurum	...	.50
Porcupine Gold	.00½	.00⅞
Imperial	.04	.04¼
Preston East Dome	.02¼	.02½
Rea	.15	.21
West Dome	.04	.04¼
Porcupine Pet.	...	.16
Porcupine Vipond	.49½	.50
Teck Hughes	.04¼	.05¼

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02¾	.02⅞
Beaver	.32½	.33½
Buffalo	.45	.70
Chambers Ferland	.19	.19½
Coniagas	4.85	5.00
Crown Reserve	.86	.90
Foster	.02	...
Gifford	.02	.02⅜
Gould	.00½	.00¾
Great Northern	.03¼	.03¾
Hargraves	...	.01
Hudson Bay	.20	.23
Kerr Lake	4.65	4.75
La Rose	.60	.66
McKinley	.34	.35
Nipissing	6.30	6.55
Peterson Lake	.21	.22
Right of Way	.03	.03½
Leaf	.01¾	.02½
Cochrane	...	.10
Silver Queen	...	.02½
Temiskaming	.32¼	.32¾
Trethewey	.17	.18
Wettlaufer	.05	.06
Seneca Superior	1.20	1.30

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

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Geo. H. Sedgewick.
James Aitchison

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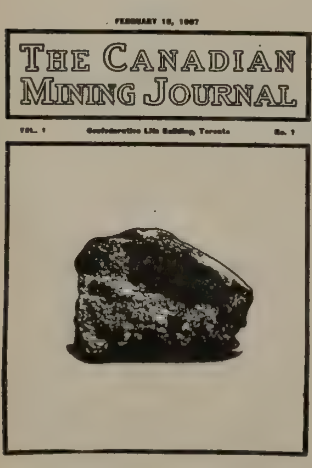

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Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.

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Stanley, W. F. & Co., Ltd.
Peacock Bros.

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Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Mussens, Ltd.

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Dominion Bridge Co.
Mussens, Ltd.

Belt Tighteners and Clamps—
Dodge Mfg. Co., Ltd.

Belting—Leather, Rubber and Cotton—
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

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Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited

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Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
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Fraser & Chalmers of Canada, Limited.
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Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

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Dodge Mfg. Co., Ltd.

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M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

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Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
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Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

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Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

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Mussens, Ltd.
Boving & Co. of Canada, Ltd.

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Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

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Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
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Mussens, Ltd.

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Mussens, Ltd.

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Can. Ingersoll-Rand Co., Ltd.

Dynamite—
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Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

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Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co
Mussens, Ltd.
Peacock Bros.

Elevator Cups—
Dodge Mfg. Co., Ltd.

Engineering Instruments—
C. L. Berger & Sons.
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Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.

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Smart-Turner Machine Co.
Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
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Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
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Fraser & Chalmers of Canada, Limited.
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Can. Ingersoll-Rand Co., Ltd

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Smart-Turner Machine Co.
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Engines—Steam—
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Mussens, Ltd.

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Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
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Mussens, Ltd.

Fixtures—Counter Shaft—
Dodge Mfg. Co., Ltd.

Flights—
Hendrick Mfg. Co.

Floor Stands—
Dodge Mfg. Co., Ltd.

Friction Clutches—
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Forges—
Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

Hoisting Engines—
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Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

Hose—
Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
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Can. Laboratories.
Milton Hersey Co., Ltd.
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Consolidated Mining and Smelting Co. of Canada.
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Canada Metal Co.

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Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

Producer—Gas—
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Pulleys—Iron, Wood Spit, Iron Centre Wood Rim—
Dodge Mfg. Co., Ltd.

Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
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M. Beatty & Sons.
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Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
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Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
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Mussens, Ltd.
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Smart-Turner Machine Co.

Pumps—Turbine—
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Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
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Sullivan Machinery Co.
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Roasting Plants—
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Rolls—Crushing—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
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Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
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Thos. & Wm. Smith.
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Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

Screens—
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
Mussens, Ltd.
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Slime Tables—
James Ore Concentrator.

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Mussens, Ltd.
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Fraser & Chalmers of Canada, Limited

Spiral Conveyors—
Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

Stacks—Smoke Stacks—
Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.

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Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
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Northern Electric Co., Ltd.

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Dodge Mfg. Co., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
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Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co., Ltd.

Transformers—
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Peacock Bros.

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Peacock Bros.

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Dodge Mfg. Co., Ltd.

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Dodge Mfg. Co., Ltd.

Tube Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

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Peacock Bros.
Canadian Ingersoll-Rand Co., Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co., Ltd.

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Roessler & Hasslacher.

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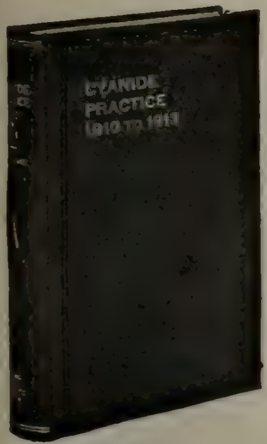

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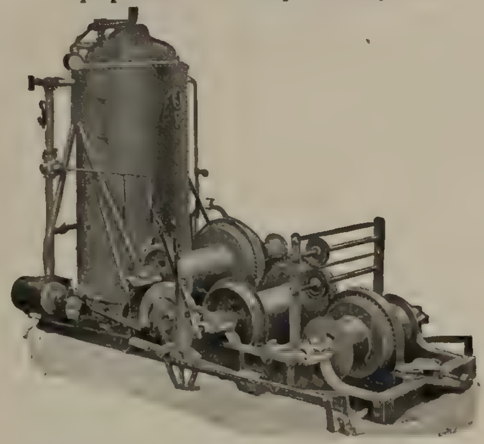

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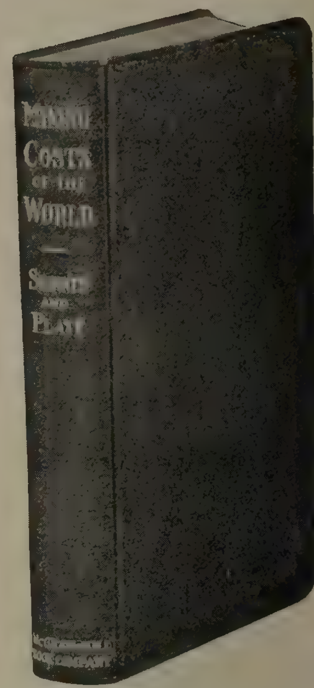

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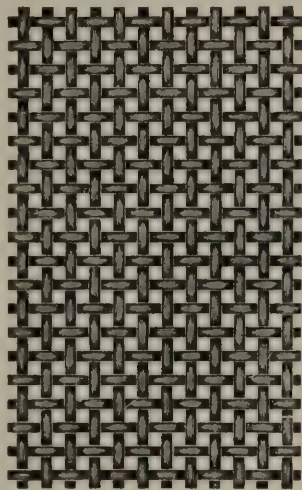

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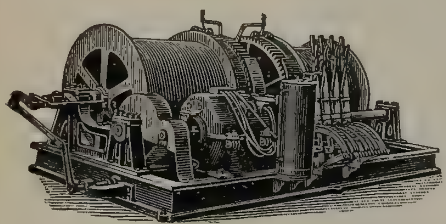

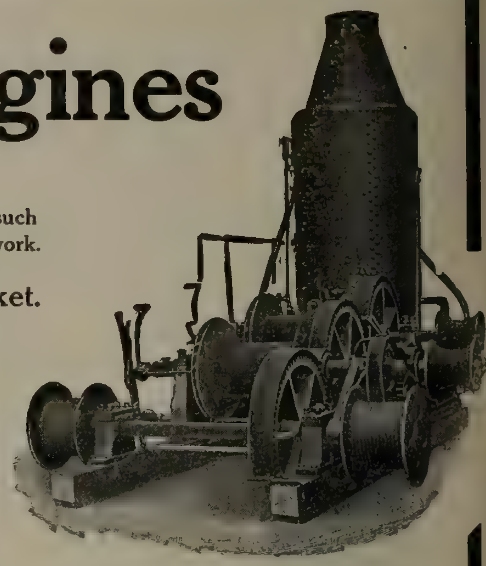

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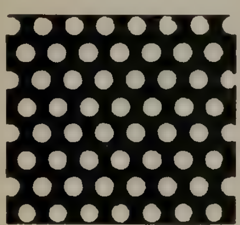

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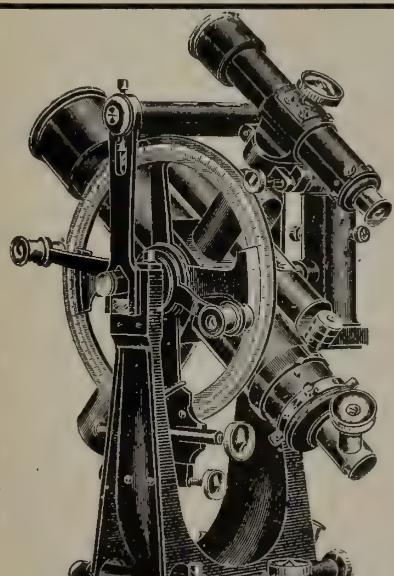

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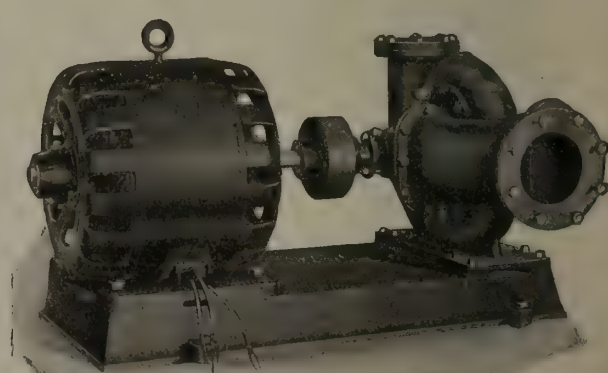

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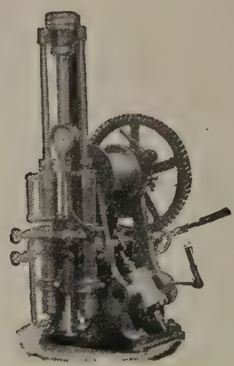

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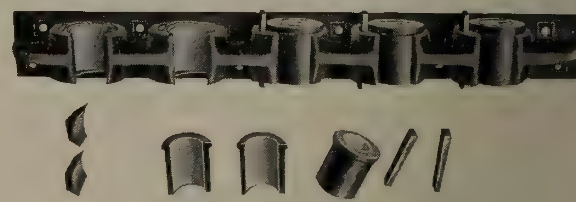

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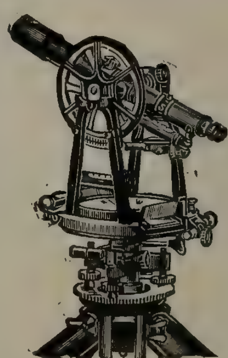

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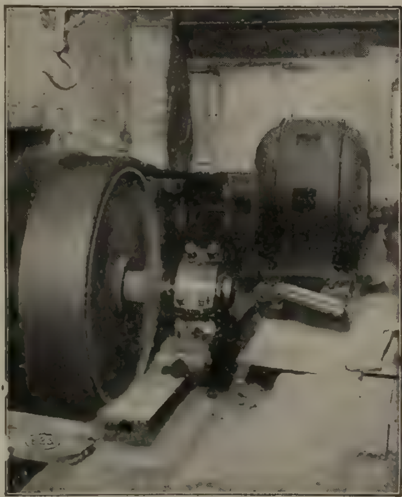

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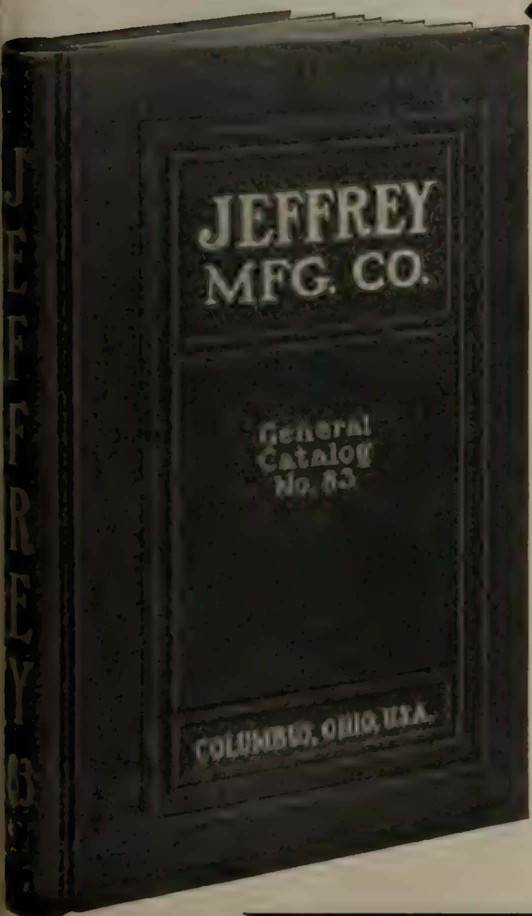

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Canadian Mining Journal

THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, May 1, 1915. No. 9

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
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Editor
REGINALD E. HORE

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CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS

BRITAIN CONTROLS COPPER OUTPUT

The announcement that Great Britain is now in control of the world's copper supply, outside of Germany, is a source of great satisfaction. The enemy has been for years a large consumer of copper and has been unable to produce enough for his own use. For war purposes much larger quantities than before are needed and the Germans have made every effort to obtain supplies. That the British blockade is effective is clearly disclosed by the announcement that even those American companies controlled by Germans have entered into the agreement to put their output under British control.

The significance of this announcement cannot be overestimated. It shows clearly that the War Office officials responsible for the control of the supply of metals are capable of doing things which few men would have thought possible. While some of our newspapers have been at great pains to tell the Government how the nickel output should be controlled, the War Office has been quietly obtaining control of the supply of copper. Comparatively the control of nickel is a very simple matter. The control passed into the British hands practically with the opening of the war. But while most of the nickel comes from a few mines in Canada, copper is produced in large quantities in many parts of the world. That all producers have been satisfactorily dealt with by the British Government speaks volumes for the effectiveness of the blockade, for the magnitude of Kitchener's plans and for Britain's determination to push the war to a victorious conclusion.

THE DEMAND FOR COPPER

Copper is now commanding a higher price than for years. Nearly every week the producer's position is improved. The supply on hand is low and several companies are reported to be sold out for two or three months ahead. A tremendous change has taken place. Copper producing companies are in a position which contrasts sharply with their position last September.

The average price for copper over a period of several years has been about 14 cents per lb. Most successful companies make a profit of only a few cents per lb. Very few produce at a cost of less than 10 cents. The rise from 11 cents last August to the present price of 18 cents for electrolytic and 20 cents for Lake copper is therefore doubling, tripling or quadrupling the profits of some companies. In several cases companies operating at a loss last fall are now making large profits.

Obviously the war is responsible for the improved market for copper. The price has risen in the face of great increase in production and seems likely to rise in spite of the strenuous efforts now being made to take advantage of the good market. Last fall production was only one half normal and the outlook gloomy. Now copper mines everywhere are employing more men and are yet scarcely able to meet the demand.

The amount of copper used for ordinary purposes is certainly much below normal. It is becoming apparent that this is more than made up for by the use for war purposes. That such would be the case was predicted by many, but the demand for the metal in the early months of the war did not indicate that these predictions would be fulfilled. Now the demand seems insatiable and copper mining is likely to be one of the most profitable industries during the war and probably for some time after it. Much of the copper being used now will never be recovered. The demand for ordinary and reconstruction purposes after the war should be great and the copper producers will be called upon to supply enormous amounts.

PROPOSED METAL REFINERIES IN BRITISH COLUMBIA

What was described as "one of the most important commissions which has visited Victoria for a long time" arrived at Nelson, British Columbia, early in April and after spending several days there and at Trail, proceeded to the coast, reaching Victoria on April 10, and a week later, after having first been in Vancouver two or three days, left on the return journey eastward. The party consisted of Mr. David Carnegie, of London, England, stated in the local press to be a special representative of the British War Office; Dr. Alfred W. G. Wilson, chief of the Mental Mines Division Mines Branch of the Canada Department of Mines and Dr. Alfred Stansfield, professor of metallurgy at McGill University.

The Daily Colonist, Victoria, made the announcement that "in an interview Mr. Carnegie stated that their mission in British Columbia was to investigate the feasibility of establishing copper refineries, besides enquiring into the facilities for manufacturing shells and other munitions of war here." In a report of the proceedings at a meeting of the mining committee of Victoria board of trade with the commission, Mr. Carnegie is stated to have given the local men information, including the following:

"The larger part of the project, however, was to secure, if possible, the smelting and refining of all our copper supplies within the Dominion, and when this subject has been satisfactorily dealt with, it is hoped the refining of zinc would follow.

"In a normal year Canada produces 35,000 tons of copper matte. This is all exported to the United States because we have no refineries; 21,000 tons is reimported in the form of finished copper, in addition to 3,000 tons of brass of which copper forms a large part. It is desirable that this work shall be done in Canada, not only as a means of increasing our industrial prosperity, but also as a means of conserving so important an article as copper for the use of the Empire."

The report also stated that Mr. Carnegie asked for the assistance of the committee in assembling such data as would enable the commission to decide whether copper refining would prove to be a commercial proposition in normal times, and if so where would be the best place at which to establish a refinery.

The value of a part of the information offered to the commission may be gauged by some of the statements published relative to the output of copper. A Kootenay newspaper stated that: "Last year the production of copper in British Columbia exceeded 50,000,000 lbs., and estimating this year's output upon production during the first two months of 1915, it will reach about 100,000,000 lbs." As a matter of fact the production of copper in British Columbia in the first quarter of 1915 was little, if any, larger than in the corresponding period of 1914, for while the Coast district most likely produced more in the first quarter of the current year than in that of last year there was a considerable decrease in output of the Boundary and a loss of production in Nelson mining division. Further, the total production of copper in British Columbia in 1914 was estimated by the Provincial Department of Mines at 44,969,000 lbs., and by the Dominion Department of Mines at 41,222,000 lbs.

Then, an excerpt from the annual report of the Victoria Board of Trade published in the Victoria Daily Times included the following: "Just at the close of our official year a movement has developed which may have important consequences on the mining and smelting industries of British Columbia. The movement arises out of the importance which copper has assumed in connection with the war." After summarizing the objects of the visits of the commission that members of the board had interviewed a few days previously and using Mr. Carnegie's figures relative to copper production, the report continues: "The policy of our government, with a view to carrying out the wishes of the Home government, is to conserve the natural resources of the Empire for use within its borders, and especially to retain absolute control of such resources as are indispensable to the protection of the Empire. One of the most important steps in this direction would be the refining of copper in Canada. All Canadian copper is produced in British Columbia, which makes this for us a domestic question." Then follow some figures, which are but poor guesses.

Now, as to the statement that all Canadian copper is produced in British Columbia—the following figures taken from reports of the chief of the Division of Mineral Resources and Statistics, Canada Department of Mines, will show its unreliability:

Production of Copper by Provinces 1913 and 1914.

Provinces.	1913. lb.	1914. lb.
Quebec.	3,455,887	4,201,497
Ontario.	25,885,929	28,948,211
British Columbia	45,791,579	41,221,628
Other districts	1,843,530	1,367,050
Totals.	76,976,925	75,738,386

These official figures show that last year British Columbia's proportion was about 55 per cent. and in 1913 nearly 60 per cent., of the production of the whole of the Dominion. Other districts include Nova Scotia and Yukon. It should be added that the figures for 1914 represent the estimated production, final statistics not yet being available.

It is evident that some of the information proffered is misleading, but that might have been expected from irresponsible persons. Why it was sought in that way does not appear on the face of it, for no men investing their own money in any industry would be likely to ask uninformed individuals to supply them with important data. But apart from this, the desirability of established copper refinery in British Columbia is unquestionable. Whether it will be found practicable to enter into such an undertaking can only be dealt with on its merits. It is to be hoped that such obstacles as exist will be overcome and that the growing copper-producing industry of the province will be benefited accordingly.—E. J.

An amendment to the Mining Act of Ontario passed at the recent session of the Legislature, waives forfeiture for any cause in the case of mining claims held by those enlisted for active service. It would be distinctly unfair to hold enlisted men to the conditions provided by the Act and some such action on the part of the Government was confidently expected.

The ineffectiveness of Germany's blockade of the British Isles is reflected in the announcement that in March there was imported 44,000.000 gallons of petroleum, without the loss of a single oil tanker. Stocks in Great Britain are larger than they have been for several months.

The Granby Consolidated Mining Smelting & Power Co. is among the companies which will benefit greatly by the high price of copper. Granby's mine at Hidden Creek is a low cost producer; but the old mine at Phoenix is operated on a small profit per lb. at ordinary times and was closed down last August when the price fell to nearly 11 cents per lb.

Germany's finance minister boasts that owing to that country's isolation all her expenditures are necessarily made at home and that consequently Germany is prospering. If Germany's finances are not more sound than her minister's methods of reasoning our enemy is indeed in a bad way.

YPRES

In summertime a tourist stray would come—
  For thou wert somewhat from the beaten way —
And in thee, drowsing by thy still canal,
  Find charm and treasure-trove for half a day.

Thumbing his guidebook to thy buried page,
  He'd find three-starred, as worth his roving eye,
Thy Cloth Hall's noble beauty, fresh restored,
  And brave St. Martin's tower, standing by.

And from his text, and from the misty lore
  Drawled slow and broken by his Fleming guide,
Would catch some hint, from days of Charles the Bold,
  Of what were once thy glory and thy pride,—

How thou, twelve times more populous, did'st boast
  Five thousand looms—the world's prime weaving spot;
And, faring from thy shrunken streets would muse
  "Queer town, queer-named,—forevermore forgot!"

So, many summers,—then, one winter, spring,
  And fame is thine again forevermore:
On thee the men of kaiser and of king
  Have, with their hearts' blood, set their rival store.

Thy fame is loud—thy hall's, cathedral's crash
  And scream of shell its renaissance now give;
In soldiers' gossip and in widows' moan
  Lasting thy name—as place of death—shall live!

—B. F. Griffin.

Boston News Bureau.

GRANBY CONSOLIDATED.

According to the Boston News Bureau, Granby Consolidated will next week be running full blast at its Grand Forks smelter, where for the past two months six of the eight furnaces have been in commission. The two idle sections will be blown in very shortly. By July the fourth furnace will have been installed at the Anyox smelter permitting of continuous operation of at least three units.

Granby's net earnings from April operations will approximate $175,000 based on copper under 17 cents and with the Grand Forks plant running but 75 per cent. of capacity. At Anyox there will have been treated at the new smelter 55,000 tons of ore which, yielding 35 lbs. of copper per ton, should show a production of about 1,900,000 lbs. of copper.

Eighteen-cent copper and full operations mean $25 per share for Granby. Cost of producing copper at Hidden Creek has been below 8 cents a lb., landed at New York, while the cost of turning out the metal at the old plant at Grand Forks hangs around $10\frac{1}{2}$ cents a lb.

Allowing an eight-cent cost at the new smelter and $10\frac{1}{2}$ cents at the old plant, Granby earnings per share at varying copper metal prices should be about as follows:

Copper at	Per share	Bond int.	Net per share
18 cents	$25.40	$.60	$24.80
17 cents	22.52	.60	21.92
16 cents	19.64	.60	19.04
15 cents	16.14	.60	15.54
14 cents	13.26	.60	12.66

The company has outstanding $1,500,000 6 per cent. convertible bonds the interest on which amounts to $90,000 a year. There is also an issue of $850,000 non-convertible and a small floating debt. Satisfactory arrangements have been made for caring for maturing obligations.

CORRESPONDENCE

To the Editor of the Canadian Mining Journal:

Sir,—In your issue of April 1, Mr. F. W. Gray comments on the address on "The Conservation of our Mineral Resources" delivered by Dr. F. D. Adams at the recent annual meeting of the Canadian Mining Institute. In reference to Dr. Adams' statement respecting the provisions of the Nova Scotia Act requiring advance plans before a mine can be opened, Mr. Gray says:—"There is a misapprehension here, as the Government of Nova Scotia only requires advance plans to be submitted for approval in case of submarine coal areas. Advance plans are not required in case of land areas."

Mr. Gray refers to the Coal Mines Regulation Act and has evidently overlooked the Mines Act.

The Mines Act reads as follows:—Section 233. Before the work of opening any coal mine, after the passing of this Act, is begun, a plan of the coal areas proposed to be operated by any person, firm or Company, shall be submitted to the Commissioner of Public Works and Mines for the approval of the Governor-in-Council, showing the place or places at which proposed shafts or slopes are to be sunk or driven, and the area of coal to be won by each shaft or slope, and making provision for the operation of riding rakes therein, and a plan showing the number of seams to be worked at one time, the proposed system of underground workings and a calculation of percentage of coal to be extracted from each seam.

Yours etc.

CHARLES FERGIE.

Montreal, April 26, 1915.

CALUMET AND HECLA COPPER.

Makers of ammunition have been so anxious to get the best copper for their wares that they have willingly paid a premium of something like three cents a lb. for the Calumet & Hecla metal—known to the trade the world over as "C. & H." That particular grade of copper enjoys an enviable reputation, which has long been established in Europe, and the letters C. & H. have come to have something of the significance which attaches to a registered trade-mark, carrying a "good -will" which is readily translated into dollars and cents.

But it is not alone in munitions of war that C. & H. shines—literally and figuratively. The harmless, necessary shoe eyelet is made of Calumet & Hecla copper, combined with the best grades of zinc. Not only does the constant wear and tear on shoe eyelets demand a brass of the highest torsional and tensile strength, but the minuteness and peculiar shape of the eyelets, and the firmness with which they must clasp the leather, put a weak or brittle metal out of the running.

It is a far cry from ammunition to eyelets. C. & H. is supreme in both.—The Wall Street Journal.

CONSOLIDATED MINING AND SMELTING CO.

Consolidated Mining and Smelting Company, Trail B.C., state that the general feeling appears to be more confident than has been the case since the war started.

There was some difficulty experienced during the first four months of the war in disposing of products. At present, however, this matter is not troubling the Company at all.

The prospects for the coming six months, they state, appear to be very favorable.

The price of silver is very low, but both lead and copper are going out at fair prices.

GRANBY.

Granby Consolidated Mining, Smelting & Power Co. has sold $2,000,000 6 per cent. convertible bonds to White, Weld & Co.

Granby Consolidated Mining, Smelting & Power Co. $2,000,000 6 per cent. convertible bonds sold to White, Weld & Co. will be offered for subscription to stockholders of the company at par.

Through this sale the company will fund its entire floating debt and care for $850,000 non-convertible debentures maturing May 15. A substantial addition to working capital will also be made and the way paved for immediate dividend resumption.

U. S. PRODUCTION OF COPPER IN 1914.

The smelter production of primary copper in the United States in 1914 was 1,150,137,192 lbs., as compared with 1,224,484,098 lbs. in 1913, a decrease of about 6.1 per cent.

The total value of the 1914 output at an average price of 13.3 cents per lb. is $152,968,246, as compared with $189,795,035 for 1913.

MINERS FOR GOLD COAST.

Cobalt, April 28.—Mr. Charles P. C. Beresford, manager of the Prestea Block A. Co., Prestea, Gold Coast Colony, Africa, is in Cobalt for a few days to engage about 30 miners to take places of men who have enlisted for active service at his property. Of the total white strength of 180 men at the Prestea mine, 60 have gone on aitive service and it is difficult to get miners in England at the present time.

INTERNATIONAL NICKEL.

New York, April 27.—International Nickel Common is 135 bid, with little stock offered. Sales, Monday were at 132½.

The earnings for the first quarter of 1915 ran away ahead of last year, and the increase is conservatively estimated at about 35 per cent. April, it is said, will be the largest month in the history of the company.

SCHOOL OF MINING.

Kingston, April 28.—At the annual meeting of the shareholders of the School of Mining, D. M. McIntyre, chairman of the Ontario Railway Commission, was in the chair. The retiring members of the board—J. B. Carruthers, N. F. Dupuis, M. L. Hersey and James Swift—were re-elected.

LAKE COPPER AT 21½ CENTS.

Boston, Mass., April 27.—Best grades of lake copper have been advanced to 21½ cents a lb., and the market is strong at this figure.

217,000 MINERS ENLISTED.

According to reports of Premier Asquith's speech at Newcastle last week, 217,000 miners in the British Isles have enlisted. This is a record to be proud of.

REVISION OF PRE-CAMBRIAN CLASSIFICATION IN ONTARIO

By Willet G. Miller and Cyril W. Knight.

During the past decade the authors have been engaged in detailed work on pre-Cambrian areas in various parts of the Province of Ontario. The results of this work, and that of other investigators, have made apparent the necessity for revising the age classification of the pre-Cambrian rocks, particularly in the use of the terms Huronian, Laurentian and others. The following classification and nomenclature have therefore been adopted by the Ontario Bureau of Mines:

Keweenawan	
Unconformity	
Animikean	Under this heading the authors place not only the rocks that have heretofore been called Animikie, but the so called Huronian rocks of the "classic" Lake Huron area, and the Cobalt and Ramsay Lake series. Minor unconformities occur within the Animikean.
Great Unconformity	
(**Algoman** granite and gneiss)	Laurentian of some authors, and the Lorrain granite of Cobalt, and the Killarney granite of Lake Huron, etc.
Igneous Contact.	
Timiskamian	In this group the authors place sedimentary rocks of various localities, that heretofore have been called Huronian, and the Sudbury series of Coleman.
Great Unconformity ?	There is no evidence that this unconformity is of lesser magnitude than that beneath the Animikean.
(**Laurentian** granite and gneiss)	
Igneous Contact.	
Loganian Grenville (*Sedimentary*) Keewatin (*Igneous*)	The authors have found the Keewatin to occur in considerable volume in S.E. Ontario and have determined the relations of the Grenville to it.

Investigations by the junior author during 1914 have shown that certain rocks of the "classic" Huronian area of Lake Huron, the "Thessalon greenstones," that heretofore have been placed with the Keewatin, are of much later age, being in intrusive contact with the Animikean, as defined in the above table.

The preceding is an abstract of a paper presented by the authors at the last annual meeting of the Geological Society of America and printed with other abstracts by the Society. A few notes on the classification may be of interest from the economic point of view.*

The authors employ the name Keweenawan in the sense in which it has been used by most workers in the Lake Huron-Lake Superior country for a considerable length of time. The Keweenawan rocks, especially the igneous representatives, are of much economic importance as associated with them are the great native copper deposits of Michigan. The basic intrusives that gave rise to the Sudbury nickel-copper deposits and the Cobalt silver ores are believed to be of the same age.†

It will be noted that the historic name Huronian is not employed, the rocks to which this name has been given by most authors, during recent years at least, being divided between the Animikean and the Timiskamian. Field work during late years, not only by the authors but by other investigators as well, has shown that the terms Lower, Middle and Upper Huronian have been employed in such a way in the past as to lead to great confusion. Rocks, for instance, in certain localities that are now known to be younger than what is called the Algoman granite, and to be separated from it by a great erosion interval, have been classed as Lower Huronian. On the other hand certain areas of rocks that antedate the Algoman, and are given the name Timiskamian in the table, have also been called Lower Huronian. Other points that have led to confusion in the use of the name Huronian might be cited, but briefly it may be said that the authors have thought it better to discard the name Huronian rather than apply it to only part of the rocks to which the name has been given in the past. Since it was on Lake Timiskaming, an expansion of the Ottawa river, in 1845 that Logan first studied the rocks to which he later gave the name Huronian, Timiskamian seems a most suitable appellation for the older of the two groups into which his Huronian is now known to be divisible.

While it may never be possible to prove that all of the rocks placed by the authors under the group name of Animikean are of one and the same age, it simplifies the classification for economic purposes, at least, to so group them in the meantime.

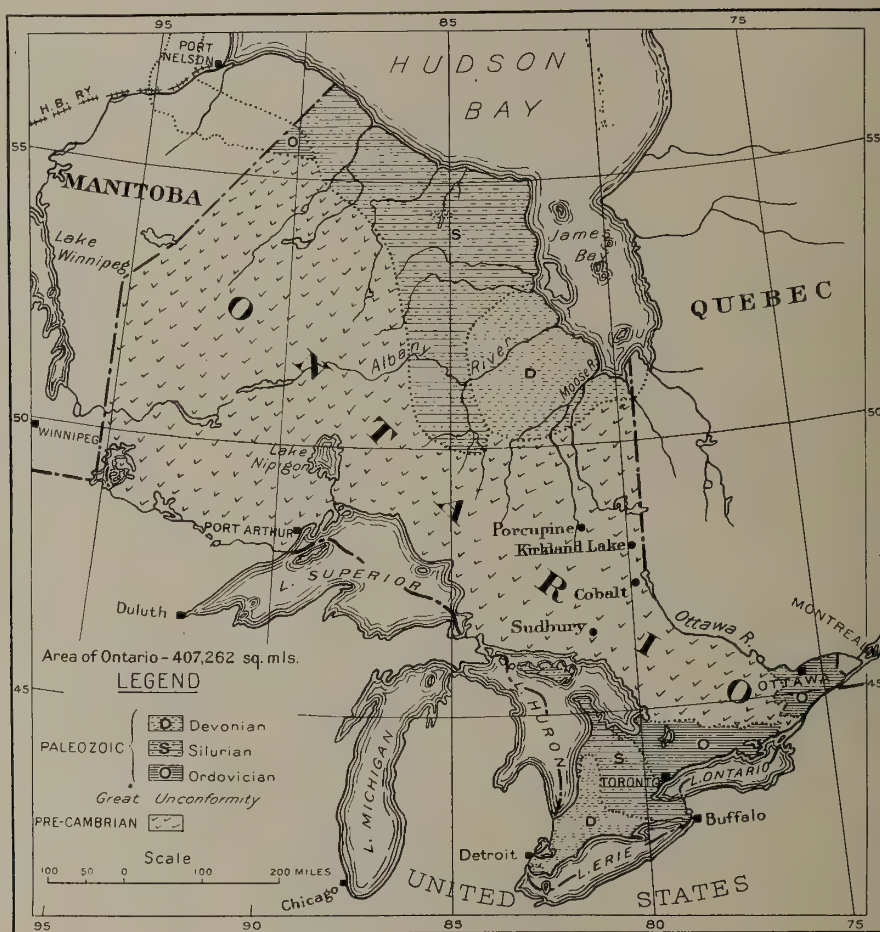
It may also be said that the grouping of certain areas of granite under the name Algoman is open to criticism, but in various areas are found granites that bear similar relationships to older and younger fragmental series respectively, and until these granites are proved to be different in age it simplifies the classification and can do little harm to consider them to be of one age, especially as these granites in numerous areas have the same economic significance, being the rocks to which the gold deposits owe their origin. Since auriferous orebodies occur in the fragmental rocks, to which the name Timiskamian is given, at Kirkland Lake, Porcupine and elsewhere, it is, of course, of much importance to distinguish this series from the fragmental group classed as Animikean and which, being later than the Algoman, does not contain ore deposits that owe their origin to these intrusives.

Erosion of Ore Deposits.

The intrusion of the Laurentian granite, in so far as can now be seen, did not give rise to ore deposits after the manner of the Algoman. But since Laurentian times there has been enormous erosion, and it is quite possible that orebodies that owed their origin to this

*See also Part 2, Vol. xxii, Ont. Bureau of Mines, pp. 122 to 138.
†Eng. and Min. Journ., June 7th, 1913, pp. 1131-1132.

granite have been removed. Considering that erosion has removed at least a few thousands of feet, there is little difficulty in picturing the destruction of numerous ore deposits of Laurentian origin. Even two or three hundred feet more of erosion in the epoch immediately preceding the deposition of the Paleozoic rocks would have left little of some of the greatest of pre-Cambrian mineral deposits. Comparatively little would have been left of the deposits at Cobalt, from which in all probability more ore was eroded than has been mined, or, for instance, of the great Mesabi iron deposits. While not entering on the recently much debated question as to the "persistence of ore in depth,"‡ it is quite clear to anyone with a knowledge of pre-Cambrian ore deposits that a few hundred feet more of erosion would at least "have taken the cream off" most of the ore deposits. Indeed, were it not for the protection that has been afforded by faulting and folding, only a small part of the ore now available would have been preserved. It is worthy of note that the only Ontario gold mines that have proved to be commercial successes are in the vicinity of fragmental rocks, Timiskamian, which have been protected through having been depressed deeply in the crust by folding or faulting. The geological maps of the Porcupine and of the Kirkland Lake areas, published by the Ontario Bureau of Mines, show that the Timiskamian group occurs essentially in synclinal belts of steeply dipping, more or less schistose rocks. There is no evidence that erosion has been less in these areas than generally throughout the regions occupied by the pre-Cambrian protaxis. The preservation of these fragmental rocks in special areas would therefore appear to be due to their having been more deeply depressed in such areas than elsewhere by folding or faulting.



The Grenville Series.

It is believed by the authors that the key of the heretofore puzzling relationship of the Grenville to the Keewatin and the so-called Huronian has been found by them in southeastern Ontario. In their judgment the age relations of the Grenville have been made clear in their recently published report on southeastern Ontario.§ The Keewatin, consisting essentially of volcanic rocks, forms a floor on which the Grenville series rests, although part of the Grenville sediments are contemporaneous with later Keewatin flows. The "iron formation" so widely associated with the Keewatin greenstones, and which is of such great economic importance in some localities, is considered to represent chemical sediments deposited in the lower part of the Grenville.

Indications of an early opening of navigation on the Yukon River are reported in advices received on April 15 by the agent at Vancouver, B. C., for the White Pass & Yukon route. Exceptionally warm weather for the time of the year was then being experienced in the North, the ice on the lower river had been practically broken up and that on Lake Labarge was already too thin for team traffic. No more shipments were being accepted for Dawson via the Lake. It is stated that the first steamer will likely leave Whitehorse about middle of May. This would be about three weeks earlier than usual.

‡Inst. Min. and Met., Bulletin No. 122 et seq.
§The Pre-Cambrian Geology of Southeastern Ontario, Part 2, xxii Report, Ont. Bureau of Mines.

THE MACKENZIE RIVER REGION*

By Charles Camsell.

The Mackenzie is one of the great rivers of the earth draining an area 682,000 square miles in extent or about one-fifth of the total area of Canada. More than one-third of its basin is still a "terra incognita" to the white man and is known only to a few small roving bands of Indians of the great Chipewyan stock. This in spite of the fact that it is 125 years since it was first descended to its mouth by that noted explorer, Alexander Mackenzie. It is, however, recently beginning to attract some attention in the commercial world among men who are willing to exploit its natural resources. The agricultural portion, namely, that within the basins of the Peace and Athabaska Rivers, has been widely advertised as "The Last West" and is being gradually opened up and settled. This portion of the Mackenzie Basin, together with that immediately to the north of it as far as the Liard River and Great Slave Lake, contains the largest area of unoccupied agricultural land in Canada and is the direction in which Canadian agricultural expansion is bound to take place. The remainder of the basin to the north and east is still largely unexplored and while never likely to support a large agricultural population offers a vast field of possibly great value to the prospector. What this portion of the basin contains in mineral resources it is impossible to say and unsafe to hazard a guess in view of the surprises we have already received in opening up similar country in Northern Ontario. It is satisfactory to note that the Canadian Geological Survey is now embarking on a scheme for the exploration of the vast tracts of unknown territory in this and adjoining portions of Northern Canada.

The Mackenzie River carries to the Arctic Ocean the drainage of 682,000 square miles of the northwestern portion of Canada. Its basin includes the northern parts of the provinces of British Columbia, Alberta, and Saskatchewan, and the western part of the Northwest Territories, covering from north to south about 16 degrees of latitude, from 53° to 69°. All the varieties of great land forms of mountain, plain, and plateau are included within its boundaries.

The basin of the Mackenzie river comprises three main physiographic provinces. On the west is the great series of parallel mountain ranges known as the Rocky Mountain system, rising more or less abruptly to heights which in the south often attain 10,000 feet and on Mt. Robson reach 13,000 ft., but in the extreme north rarely exceed 5,000 ft. Many of the stronger tributaries of the Mackenzie cut deeply into these ranges and some, indeed, such as the Liard and Peace, cut right through them, drawing some of their water from the western or back slopes of the ranges. The eastern boundary of this mountain region is fairly definite though not a direct line. Starting from a point about the intersection of latitude 53° and longitude 116° the line runs northwestward crossing the Peace River about Hudson's Hope and striking the Liard River near longitude 125°. Here there is a great bay in the mountains and their continuity is interrupted by the Liard river which cuts directly through them. Under the name of Mackenzie mountains they spring up again, however, immediately north of that river, but their eastern front has now been stepped far to the eastward and abuts on the Liard river at Fort Liard as if they had been displaced by a great fault along the valley of Liard river. From here the line runs northward touching the Mackenzie river at the mouth of Nahanni river and continuing thence along the western side of Mackenzie river to latitude 65° 30', where it turns in a broad curve and sweeps westward around the head waters of Peel river. The Mackenzie mountains which are one of the largest blocks of the whole Rocky Mountain system die out in this region but another, lower, range springs up north of Peel river and extends down to the Arctic coast, its eastern front following closely the valley of Peel river and rising as an abrupt fault scarp out of the delta of Mackenzie river.

The mountain province at nearly all points merges gradually by a decrease of elevation and a flattening out of the surface into the lowland province which occupies the central portion of the Mackenzie Basin. This province is a broad northward sloping lowland through which the Mackenzie flows gently to the Arctic. It is a country of lakes and muskegs and of meandering streams flowing in moderately shallow valleys. The evenness of its surface is only broken here and there by a few rounded wooded hills or ranges such as the Cariboo mountains north of Fort Vermilion, the Horn mountains west of Fort Simpson, and an unnamed range of hills which lies east of the Mackenzie from Fort Wrigley to Great Bear river.

The Mackenzie lowland is the northward extension of the Great Plains region of the central part of the North American continent. It occupies a position in the north similar to that to the south through which the Mississippi flows southward to the Gulf of Mexico In contrast to the Mississippi region, however, the Mackenzie lowland is forested to its mouth and it embraces within its limits three of the largest lakes on the continent.

The eastern province of the Mackenzie Basin is part of the great Laurentian plateau which occupies such a large part of northern and eastern Canada and almost completely encircles the great inland sea of Hudson Bay. The western boundary of this region is not sharply defined topographically but it coincides with the eastern border of the Paleozoic rocks which underlie the lowland region. It is a country of numerous lakes and of rivers flowing in ill-defined and shallow valleys. On a broad view its surface is level or rolling but in detail it is rugged, broken and rocky with little or no surface veneer of soil or loose material to cover the inequalities of the bed-rock. Its northern portion is treeless and is known as the Barren Lands.

The physical features of the Mackenzie Basin then are these: A mountainous highland on the west; a low-lying, rugged, rocky and partly treeless plateau on the east; and in the middle a broad, almost level, forested lowland with the trunk stream like a great artery flowing northward to the Arctic sea, fed on one hand from the melting snows of the mountains and on the other hand from the numberless lakes of the plateau region on the east.

The Mackenzie ranks as one of the eight great rivers of the earth. Its length is reckoned at about 2,800

*Extracts from an article published in Science Conspectus, Boston, 1915.

miles to the head of Peace River and its volume has been estimated to be about half a million cubic feet per second. It is exceeded on this continent only by the Mississippi in length, volume and drainage area, but it is greater in length and drainage area than the St. Lawrence.

It is a magnificent natural waterway allowing steamers of five feet draft to ascend without interruption from the Arctic Ocean 1,400 miles to the rapids on Slave river at Fort Smith. Above this it is navigable again for lighter draft steamers on the Peace and Athabaska rivers for a total length of about 1,500 miles in three sections. Including its great lakes and those tributary streams which have already been explored it has a total length of navigable river and lake shore line of nearly 7,000 miles, interrupted, however, at three points, namely, the sixteen miles of rapids on Slave river at Fort Smith, the rapids and falls on Peace river below Vermilion, one mile in length, and the ninety miles of rapids on Athabaska river above Fort McMurray.

The following table presents the details of these navigable waterways, the distances being in round numbers:

Navigable Waters of Mackenzie Basin.

	Miles
Lower Mackenzie river section—	
Mackenzie river, below Great Slave lake..	1,000
Peel river, to mouth of Wind river	250
Great Bear river	90
Shore line, Great Bear lake	1,360
Liard river	440
Shore line, Great Slave lake	1,440
Slave river, Great Slave lake to Fort Smith	200
Total...............................	4,780
Athabaska Lake section—	
Slave river, Athabaska lake to Smith Landing................................	100
Peace river, Slave river to Vermilion Falls	220
Shore line, Athabaska lake	560
Athabaska river, Athabaska lake to McMurray...........................	170
Clearwater river	80
Total...............................	1,130
Peace river section—	
Peace river, Hudson's Hope to Vermilion Falls............................	550
Athabaska river section—	
Athabaska river, Grand Rapids to McLeod River..............................	325
Lesser Slave river and lake	115
Total...............................	440
Total for whole Mackenzie Basin.....	6,900

Steamers ply on all four sections of the waterways of the Mackenzie Basin, but, as they are operated solely for the benefit of the fur-trading companies and the missions, they merely follow the main routes, which are the Peace, Athabaska and Mackenzie rivers. Some of these steamers are equipped with passenger accommodation and it is possible for travelers to make the journey in comfort from the end of the railway line at Athabaska to the head of the delta and return by securing a passage from one of the fur-trading companies.

The season of navigation extends over about four months and in the southern portion of the region, namely, on the Peace and Athabaska rivers, it is somewhat longer.

These waterways are destined to become more and more important as settlement and development of the country advance because, as they have been in the past so will they continue to be in the future the main highways on which the commerce of the country must be carried. Railways will supersede them to a certain extent, but only in the southern half of the region will they be likely to do so where the population will be mainly a farming population. Farther north where no industries are likely to develop that require a large resident population the waterways will continue to be the lines of trade and transportation for years to come.

The natural resources of the Mackenzie river region include minerals, furs, timber, game and fish, and agricultural land.

To appreciate its possibilities in mineral wealth it is necessary to have some idea of the rock formations which comprise the geology of the region.

The eastern portion of the basin is covered by very ancient rocks of pre-Cambrian age. In this region are large bodies of granite or gneiss that have been intruded into older sediments and volcanic rocks of Keewatin and Huronian age of which only remnants are now left here and there in the granite batholiths. On this complex of igneous and sedimentary rocks rest patches of what are probably Keweenawan rocks.

The mountains on the western border of the basin are built up mainly of Paleozoic sediments which have been thrown by compression into a series of parallel ranges striking in a general northwesterly direction.

The lowland portion in the centre consists of flat-lying or gently undulating beds of limestones and shales of Devonian age, which are covered in the southern portion of the basin by a thick sheet of Cretaceous sandstones and shales. Patches of Cretaceous rocks and smaller areas of Tertiary also rest on the Devonian floor in several places in the northern part of the basin.

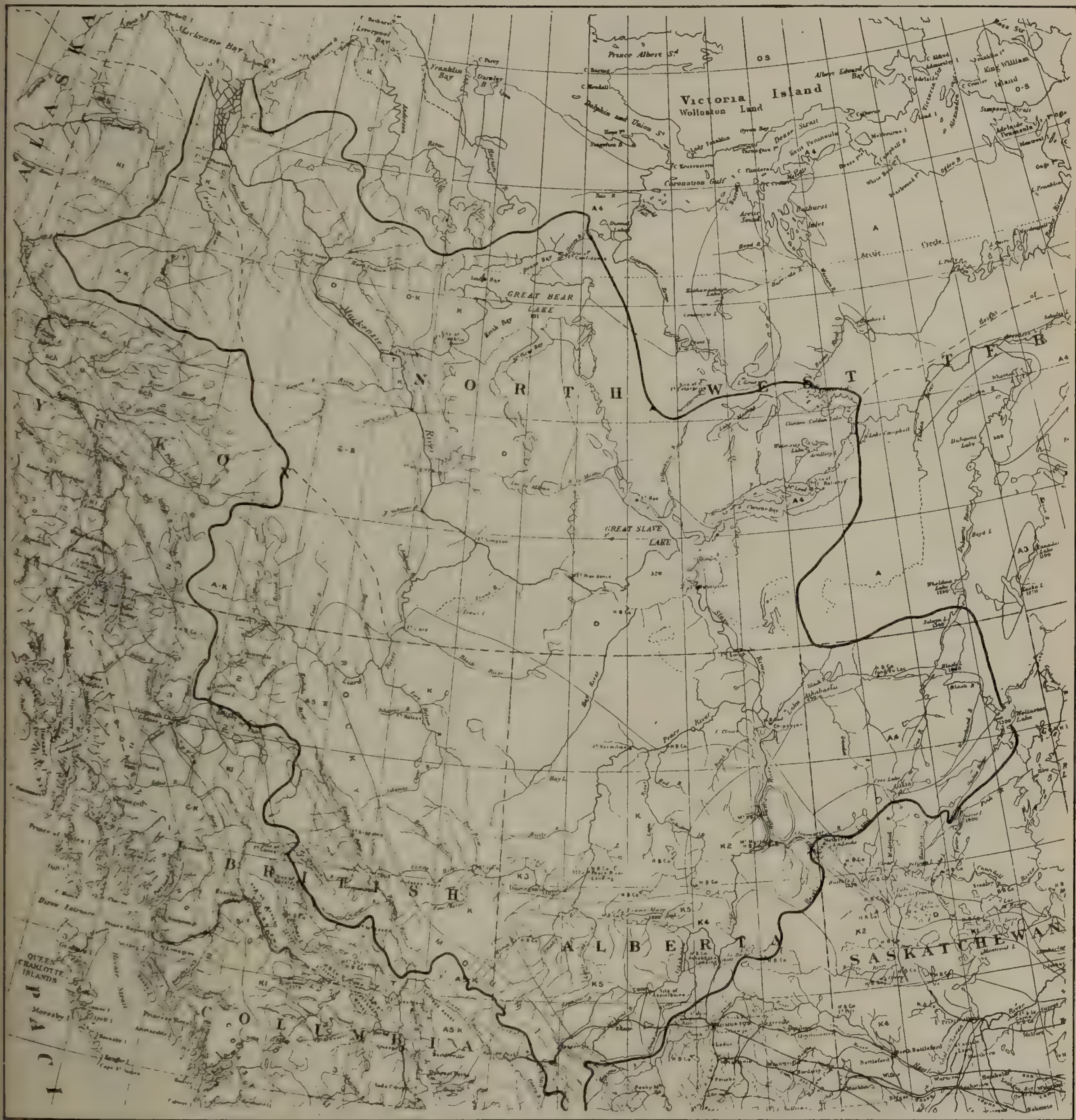
The pre-Cambrian rocks of the east are known to contain iron, copper, nickel, and gold, but little is known of them beyond their actual occurrence in place and in no case has there been as yet any production of these metals. Iron ore occurs on the islands both of Great Bear and Great Slave lakes. Copper ore is known at several points, but probably the most important locality is to the north and east of Great Bear lake where it occurs in the native state in rocks similar to those on the south shore of Lake Superior. Evidences of nickel occurring under conditions similar to those at Sudbury, Ontario, have recently been discovered at the east end of Athabaska lake. Gold ores are known in several places in quartz veins in the older pre-Cambrian sediments where they are cut by the Laurentian batholiths.

The pre-Cambrian of the eastern part of the Mackenzie Basin and of the region eastward to Hudson Bay is still virtually unexplored and these rocks comprise the largest area of unprospected ground on the North American continent. Elsewhere rocks of this age and character contain some of the greatest copper, iron, nickel, silver and gold mines of the world and it is not unreasonable to suppose that similar deposits will be found in this vast northern region.

The mountainous, western portion of the Mackenzie Basin, because it is made up mainly of sedimentary

rocks, has not the variety of metallic minerals that are found in the east. Coal occurs at several points on the eastern edge of this portion of the basin in rocks of Cretaceous age, and beds of salt and gypsum in some of the older rocks. Where, however, such tributaries of the Mackenzie as the Peace and Liard cut far enough back into the heart of the ranges to reach a region in which igneous intrusion has been active there again evidences are found of gold, silver, copper and lead ores. The Omenica district of the Peace river and the Cassiar district of the upper Liard have each produced placer gold amounting to several million dollars, and it is quite possible that in the great unprospected region north of the Liard river gold fields, if not as great, but of considerable importance, may yet be found. Of this there is already some evidence.

The lowland portion of the basin because of its being underlain by almost undisturbed rocks of a sedimentary nature is not likely to be rich in metallic minerals. It does, however, contain such non-metallic minerals as coal, salt, gypsum, oil and gas, and the metallic minerals, lead and zinc.



The Mackenzie River Region

Coal occurs in abundance in the Cretaceous rocks of the Athabaska, Peace, and Nelson rivers, and to a less extent in the Tertiary. Two of the Tertiary coal fields, namely, one at the mouth of Great Bear river and another on Peel river, are on fire and have been burning at least since Alexander Mackenzie descended the river

in 1789. The fire is probably due to natural causes in spite of the Indian story that it was started by a legendary hero of theirs in order to cook his dinner of beaver.

Salt and gypsum are associated together at a number of points in Devonian rocks. Brine springs situated west of Fort Smith are the source of all the salt used in that northern country, while other brine springs and outcrops of rock salt occur at several other points, notably in the neighborhood of Fort Norman.

Oil and gas.—The most important mineral product of the lowland portion of the basin, however, and possibly of the whole of this portion of Canada are oil and gas, evidences of which are found from the height of land on the south to the Arctic Ocean on the north. The original source of both these substances is believed to be in the Devonian rocks and since these rocks cover about half of the total area of the whole Mackenzie Basin the possibility of discovering oil pools of importance in this region is excellent. Gas has been proven in great quantity by several drill holes, but little intelligent effort has so far been directed to the search for oil. Some drilling has been done on the Athabaska river but sites for the drill holes have more often been determined by the suitability of the ground for camps rather than by a study of the rock structure. The result has consequently been disappointing.

The fisheries of the great lakes of the Mackenzie, namely, those of Athabaska, Great Slave, and Great Bear lakes, are among the most valuable of the assets of the region. Whitefish and lake trout are the principal fishes, and although fish is the principal food of the majority of the population and hundreds of thousands of pounds weight are consumed annually, this amount is so small in proportion to the quantity these lakes must contain that there is no evidence that they are being exhausted. Fisheries are made annually on Athabaska and Great Slave lakes, but Great Bear lake which contains the finest quality and the greatest variety of fishes, is virtually untouched. Whitefish in this lake go up to 12 lbs. in weight, and trout to 50 or 60 pounds.

The fur trade is at present the most important industry in the Mackenzie Basin and with the exception of the farming and ranching communities in the extreme southwest of the basin virtually the whole population is more or less directly interested on this business. The history of the region is intimately bound up with the operations of the fur traders; and the few scattered settlements that are situated at intervals of 100 to 200 miles along the valley of the main rivers were originally established and are still maintained for the purpose of trading furs with the natives. Nearly all the different kinds of high grade furs such as fox, sable, mink, marten, ermine, lynx, beaver, otter are obtained in the region, and the Hudson Bay Company, probably the greatest fur-trading company in the world obtains the greater part of its furs from here. Canada exports over five million dollars' worth of furs annually, and of this amount the Mackenzie Basin supplies probably one-third.

Of the agricultural possibilities of the region few people yet have any idea whatever, though the public is beginning to awake to the value of the land within the basins of the Peace and Athabaska rivers, and railway lines are being built into this region with the object of settling it up. There is also a vast area north of the Peace river as far as Great Slave lake and the Liard river of which we know little, though sufficient to prove that it is suitable for agricultural purposes. Altogether there is in this southwestern portion of the Mackenzie Basin an area of about 200,000 square miles suitable for settlement and there are no climate or other reasons why a self-supporting population amounting to some millions may not live and thrive there on the products of agriculture. This whole region more than any other is the direction in which Canadian expansion in agricultural pursuits is bound to take place.

Forest products might be mentioned as another of the natural resources of the Mackenzie Basin. The whole of the basin down to the Arctic coast is thickly wooded with the exception of the northeastern border which is included in the so-called Barren Lands. The principal trees are spruce, tamarack, banksian pine, birch, and poplar. One of the uses to which these trees will eventually be put will be for the manufacture of pulp. The spruce, however, is a useful tree for lumber and it grows to sizes suitable for this purpose on the banks of all the streams even as far north as the delta of the river. Large areas have been burnt and the timber destroyed by the natives because they say that it improves the hunting. Forestry protection, however, is being undertaken by the Government and the effects of this are already noticeable in the decreasing number of forest fires.

The natural resources of the Mackenzie Basin are sufficient evidence that its future is assured, for there are no difficulties, climatic or topographic, such as to prevent men of means and enterprise from entering and remaining in the country to develop these natural resources. Settlement of course must begin at the south and progress northward until the limit is reached. The nothern limit for the settlement of an agricultural population in any great numbers will probably be about latitude 62° north, but there are no doubt numbers of chances for mining communities to spring up north of this and in the less hospitable country that forms the rocky region along the eastern edge of the Mackenzie Basin.

CALUMET & HECLA.

Between eight and nine thousand men will be immediately affected by the increase in wages announced for employees of the Calumet & Hecla Mining Co. and allied corporations. Ultimately, however, a great many more will benefit as practically every mining and milling company in the Lake camp is gradually increasing forces.

Tamarack which has but 150 men working at present, resumed operations a week ago. This company will take on about 400 more men in the near future. Ahmeek will reopen shafts No. 3 and 4 within a month or six weeks and will add two to three hundred men to its mining forces and probably 50 to the force at the mills. Osceola, Isle Royale, White Pine, Hancock, Quincy and other companies are adding to their forces right along.

The companies not associated with the Calumet & Hecla are expected shortly to announce wage increases restoring the scale in effect prior to Sept. 1, 1914.

Employees of the several companies announcing increases for May 1 are as follows: Calumet & Hecla, 5000; Lake Milling Co., 130; Lake Superior Smelting Co., 150; Ahmeek, 500; Allouez, 300; Isle Royale, 650; Centennial, 150; Osceola Consolidated, 1,200; Superior, 150; Tamarack, 150.

The salaried men connected with the Calumet & Hecla and allied companies, whose wages were reduced 15 per cent. last fall, were restored to the old scale March 1.

BITUMINOUS SANDS OF NORTHERN ALBERTA*

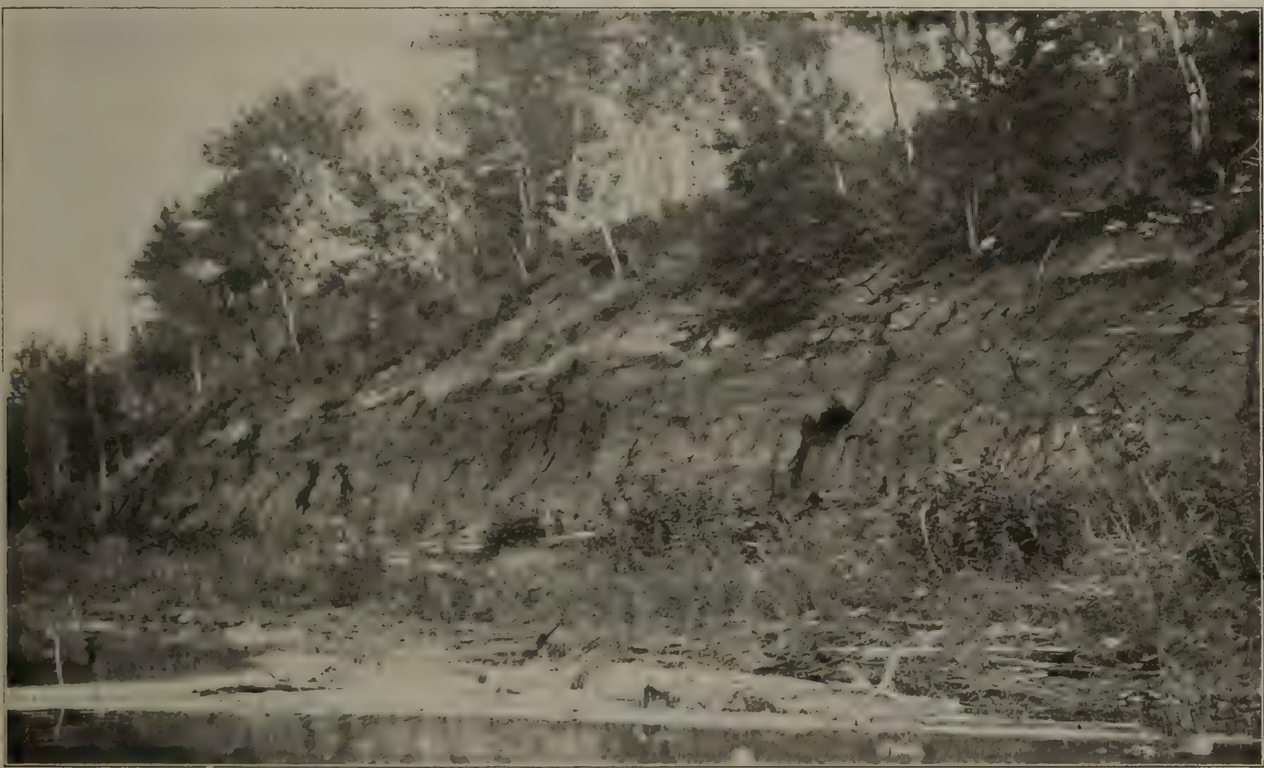
By S. C. Ells.

While much of the areal geology of northern Alberta is known, there is, at the present time, very little definite information available, official or otherwise, with regard to the extent and actual value of the mineral resources of this area. But notwithstanding the lack of detailed exploration and prospecting—which has been discouraged in the past, because of the absence of adequate transportation facilities—the occurrence of deposits of bituminous sands and sandstones has long been recognized. And when, in the near future, the proposed Alberta and Great Waterways railway is completed, it is fully expected that the greatest hindrance to the development of the mineral and other natural resources of the region, will be removed.

At the present time the commercial value of certain classes of bituminous sands and sandstones depends altogether upon their use in a more or less crude condition, in the construction and surfacing of certain classes of roads and pavements. The possible commercial extraction of the included bitumen, and the question of the possible derivation of by-products will not, therefore, be discussed in the present paper.

The bituminous sands of Alberta, heretofore commonly referred to as "tar sands," outcrop at a large number of points along the Athabaska river and its tributaries, for many miles to the north and south of McMurray. Certain of these outcrops represent portions of the deposit that should prove to be commercially valuable, but it is also true that a very large portion of the area underlaid by bituminous sands cannot be considered as of any present economic value. Although the area represented by actual outcrops has not been accurately determined, it is probably not less than 750 square miles. Extensions of the deposit under heavy cover, particularly toward the south, will greatly increase this estimated area.

In the McMurray district, there is thus a very large body of bituminous sand, the prospecting and development of which will be confined to stream valleys. The following constitutes a summary of the outcrops noted by the writer:—



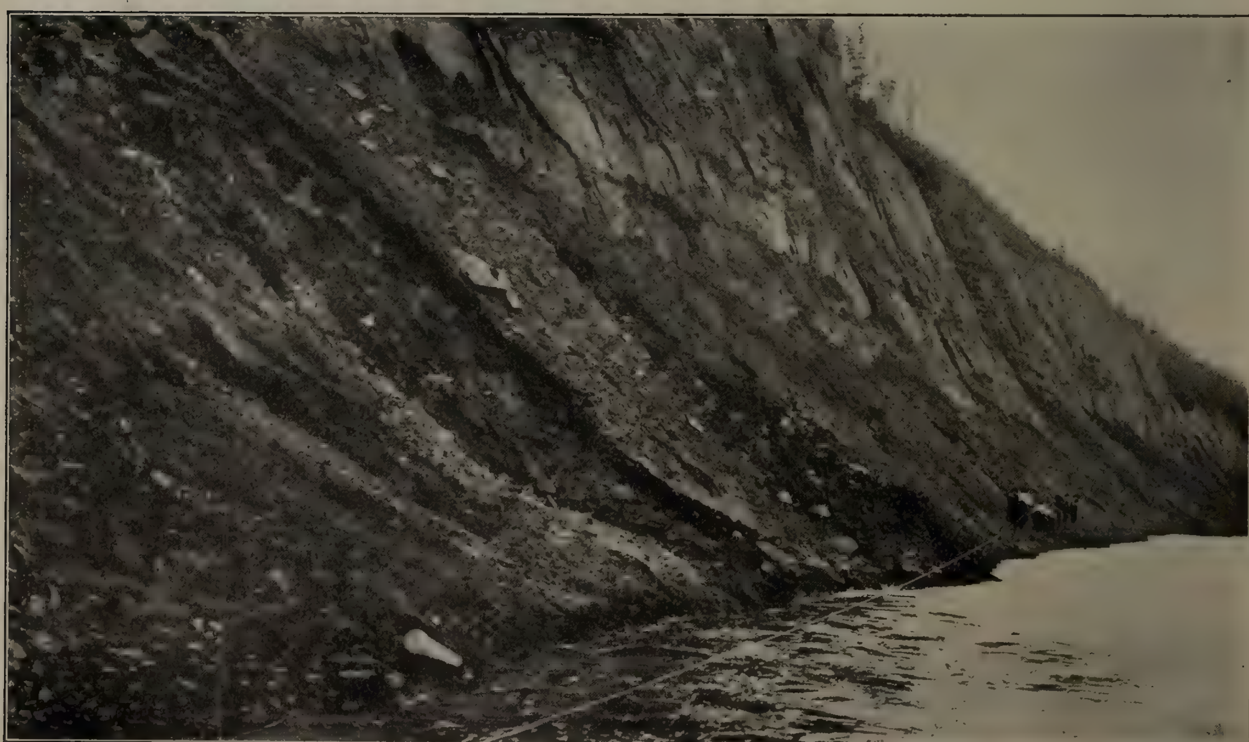
Exposure on east side Athabaska river, half mile below mouth of Pierre au Calumet. This illustrates a bed of bituminous sand under light overburden.

Name of stream.	Distance through which exposures recur miles	Number of separate outcrops noted.
Athabaska river	105	55
Horse creek	6	32
Hangingstone river	6	11
Clearwater river	1	1
Christina river	9	31
Steepbank river	13	35
Muskeg river	7	4
Calumet river	3	8
Tar river	6	7
Moose river	13	25
McKay (Red) river	16	38
	185	247

Only after careful exploration by means of adequate equipment can the true value of any deposit be affirmed. Nevertheless, owing to heavy overburden and lack of

*Extracts from a report published by the Mines Branch, Ottawa.

Typical exposure of bituminous sand in north bank of Horse creek, three-quarters of a mile from the mouth. Approximate thickness bituminous sand 90 feet; thickness of overburden, 400 feet from edge of creek, is 120 feet.



Exposure on east side Athabaska river, just below Mountain rapids. Although the bituminous sand here attains a thickness of over 150 feet, the overburden is very heavy.

Exposure on north side of Steepbank river, three and one-third miles from mouth, illustrating typical massive structure and cleavage of many of the high grade deposits of bituminous sand.

Exposure on east side Athabaska river at Crooked rapids, illustrating the angular cleavage and weathering typical of lower grade deposits of bituminous sand-rock.

uniformity in the quality of bituminous sand, it is probable that quite 80 per cent. of the exposures may be eliminated from further consideration at the present time. Considerations affecting transportation will still further reduce the remaining number. Certain of the outcrops should, however, lend themselves to development on a commercial scale.

The present application of bituminous sand-rock is limited to its use as a paving material. The value of the Alberta product for such a purpose can best be demonstrated by actual experimental paving construction. Meanwhile it appears that if the development of the Alberta deposits of bituminous sand is possible, success will largely depend on making no false move in the first place, and in having no "lost motions" in operating the quarry itself.

A process that can be successfully adapted to an efficient commercial extraction of the bitumen from the sand aggregate, would prove of very considerable value in any attempts that may be made to utilize these deposits of bituminous sand. After considering the many attempts at such extraction that have been made during the past twenty years, the writer does not know of any instance where the outcome has proved a commercial success. It appears, however, that under favorable conditions the development of a successful extraction process may be possible.

Meanwhile, the discovery of petroleum fields in western Canada will have a direct bearing on any proposed development of the Alberta deposits of bituminous sand.

Bituminous sands have, for a number of years, been used in the construction of various classes of pavements in the United States. The principal sources of supply at the present time are in Kentucky, Oklahoma, and California. The extent to which the material has been used, appears to have been determined to a considerable degree by the fixing of freight charges. Apart from this consideration, political interests and the somewhat questionable methods peculiar to the asphalt paving industry itself, should also be borne in mind.

From personal observation in various cities and towns in the United States, the writer believes that pavements constructed largely from bituminous sands have been satisfactory. Certain of these pavements have been subjected merely to the comparatively light traffic of residential streets, while others have been tested under severe traffic conditions. On the other hand, many pavements laid with bituminous sand have proved unsatisfactory.

From a consideration of the successes and the failures that have resulted from the use of bituminous sand rock, the writer would, in the strongest possible manner, emphasize one conclusion. It is, that the most careful study should be given to its chemical, but more especially to its physical, character, as a preliminary step to actual attempts at paving. To handle our Canadian bituminous sand in a haphazard manner, either through failure to intelligently appreciate its true nature, or through lack of proper manipulation, will simply be to court failure and serious financial loss. The writer considers that the construction of one or more types of experimental pavement, will prove to be the most satisfactory method of actually determining the real value that should attach to bituminous sand from the Alberta deposits.

Typical exposure Grand Rapids sandstone, at Grand rapids, Athabaska river, showing spherical concretions.

Advices from Seattle, Washington, state that ten employees of the Alaska Engineering Commission left that point on April 14 for Ship Creek, Cook Inlet, to start activities on the Alaskan Government Railway. A large quantity of supplies was sent with party and will be followed by further shipments. Another party of 45 men will follow the advance contingent on the next steamer for the north from Seattle. Heavy machinery and construction parties will be despatched later.

METALLURGICAL PRACTICE IN THE WITWATERSRAND DISTRICT, SOUTH AFRICA*

By F. L. Bosqui, Johannesburg, Transvaal.

The history of the development of gold metallurgy in South Africa is divisible into two periods: That preceding the introduction of the cyanide process on a commercial scale in 1890; and the 24 years intervening between that important event and the present time.

The period between the discovery of the banket reefs of the Witwatersrand and the year 1890 was one of phenomenally rapid progress in mining development, but of no special interest to the metallurgist. There were no strikingly original or distinctly local advances in the treatment of gold ores. Californian practice in stamp milling and amalgamation prevailed, in mills ranging in equipment between 5 and 50 stamps, operating within a wide range of efficiency, and under the trying conditions usually encountered in a new and isolated field.

Assuming that the recovery at that time was as high as 60 per cent., the recoverable gold lost in tailing from the ore treated during this first period, in spite of the precaution taken in some instances to impound this product, must have been very considerable. It is evident, therefore, in view of the colossal strides made by the industry at this stage, and the promise revealed for the future, that the advent of the cyanide process was most opportune.

The introduction of the cyanide process was the direct result of trials conducted at the old Salisbury battery in 1890 by the Cassel Gold Extraction Co., of Glasgow, which controlled the MacArthur and Forrest patent rights. Its first application on a commercial scale was in the same year, in the treatment, by contract with the Gold Recovery Syndicate, of 10,000 tons of tailing on the Robinson Gold Mining Co.'s property, under the direction of G. A. Darling. In February, 1891, W. A. Caldecott started the cyanide works at the Sheba mine in the Barberton district; and a year later, Charles Butters erected a large plant at the Robinson mine to treat all the tailing from that property. From this time cyaniding was recognized as an indispensable adjunct to every mill. It was not, however, until 1894 that the direct treatment of battery slime became a success. The first decantation slime plant was erected in this year at the Crown Reef mine, under the direction of J. R. Williams, at that time chief metallurgist for the Rand Mines, Ltd., who evolved the process after several years of practical trials.

In the meantime, in 1894, the Siemens-Halske electrolytic method of gold precipitation was introduced at the Worcester mine, and was adopted by several other properties. But in spite of able advocates it never won general acceptance, owing, broadly, to the extreme delicacy of the process, the formation of troublesome by-products, and the high degree of skill required to maintain uniform efficiency; and after exhaustive comparative trials with zinc and electrolytic deposition at the Nourse Deep mine in 1898, it was finally abandoned in favor of zinc. Fortunately, a serious objection to zinc precipitation—namely, the difficulty of precipitating from the very dilute cyanide solutions used in slime treatment—was partly overcome at about this time by the use of acetate of lead as a "dip" for zinc shavings, which coated the zinc with metallic lead, forming a zinc-lead couple which greatly promoted galvanic action in the zinc boxes.

With the reversion to the use of zinc, Rand metallurgical practice may be said to have crystallized into a general scheme of milling and of separate sand and slime treatment by cyanide, which came to be looked upon as typically South African, having been, with the exception of stamp milling, evolved by local chemists and metallurgists. Even the introduction of tube mills in 1904 did not seriously modify the main features of the system. The tube mill became simply an accessory to the stamp. This survival of the broad principles of ore treatment, as developed by the clever metallurgists whose services the industry was fortunate enough to secure at the beginning, has been attributed to a narrow disinclination to adopt new methods as applied in other parts of the world. This view, however, must be very considerably modified.

The tube mill and vacuum filter.—It is true that the metallurgists of the Rand were slow to accept the two most notable appliances introduced into the treatment of gold ores in the last 10 years—the tube mill and the vacuum filter. The former was introduced in Africa in 1904, after having been for some time a success in Australia; the latter in 1909, after four years of brilliant success in America and elsewhere. The Boer war undoubtedly retarded the introduction of tube milling, and it must be admitted that when once tried, and their merits proved, both innovations were very generally and enthusiastically adopted. The fact that such radical measures as "all sliming," dry crushing, and numerous schemes for continuous treatment of battery pulp by agitation have not found favor on the Rand is evidence, not of lack of enterprise or open-mindedness, but of the proper estimation of unique local conditions, and the conviction that any system of treating the low-grade Rand ores must fulfill the essential requirements of "foolproof" simplicity in operation, low maintenance and treatment cost, and high efficiency.

Sorting and Breaking Ore.

Ore sorting on the Rand has been the subject of a good deal of discussion. It has been suggested that all sorting should be done underground, while authorities have differed as to what proportion should be done underground and what on the surface. A kind of crude preliminary sorting is now done below the surface, consisting in hand breaking of pieces of ore too large for convenient handling. Obviously, the technique of ore sorting is a matter to be dealt with independently on each mine. The present practice is to sort above ground, at a central sorting and breaking station, where both operations are usually carried on under the same roof. These stations are of great variety, but the general principle is the same in all.

The ore, on reaching the surface, is divided into two products by means of grizzlies, which take it direct from the skips in the headgear; the "fines," which it is impossible to sort economically, go direct to the mill bin; the coarser product is then delivered either (1) to grizzlies or (2) to trommels, where it is washed and screened preparatory to hand sorting. Or, in older

*Extracts from a paper to be presented at the San Francisco Meeting, American Institute of Mining Engineers, September, 1915.

plants, the grizzly and trommel are omitted, and washing is done by means of sprays on the same belt or table on which sorting is performed. Washing the ore is necessary in order to enable sorters to distinguish between banket (conglomerate ore) and waste. It is now recognized that this operation cannot be thoroughly performed except in washing and screening trommels, and the latest plants are all equipped with this device. From the trommel or grizzly the washed ore is delivered to either a revolving table or a traveling belt.

The advantage of the sorting table is that it permits of a compact plant, and so simplifies supervision; but the belt has now almost entirely superseded the table, its advantages being that it is cheaper to install and operate and that it elevates and conveys the ore as well as provides a sorting surface.

The sorted ore is delivered to breakers, of which there are two types in common use, the Blake-Marsden jaw type with its variations, and the gyratory type, of which the Gates is generally used. The gyratory breaker is the type now accepted by the Rand Mines and Consolidated Goldfields groups, and is considered more efficient and cheaper to operate where large tonnages are handled; the jaw crusher, however, is a simpler machine, of relatively less weight and requires less vertical height. The gyratory crusher is particularly well adapted to the finer breaking, while for coarse preliminary breaking, before sorting, where the production of fines is objectionable. The jaw type is preferred.

There is still a divergence of opinion as to the extent to which breaking before sorting should be carried. In some mines breakers are placed underground, with the jaws set to 4 to 8 in. opening, to reduce the ore to suitable size for handling in the skips and for sorting; more often these breakers adjoin the headgear. Where they are omitted altogether, it is in recognition of the theory that it is better to send a high percentage of waste to the mill than reduce the waste to smaller pieces, and so improve the accuracy of sorting while increasing the aggregate gold content of the waste dump. It will be seen from the foregoing that the practice in dealing with the ore before it goes to the mill is exceedingly variable. Within the last four or five years, however, the technique of sorting and breaking has greatly improved, and there is now apparent, among the groups erecting new plants a disposition to collaborate in an effort to bring about more uniformity in practice and mechanical arrangement.

Stamp Milling.

The gravitation stamp has retained its place on the Rand as the simplest and most effective appliance for crushing ore. Until the recent introduction of the heavy single-stamp unit, the general features of ore crushing have undergone no very radical change since the introduction of Californian mill practice over 20 years ago. The most marked departure from the typical 900-lb. stamp of those days is in the progressive increase of weight. This interesting evolution from the light to the heavy stamp has probably now reached its limits in the adoption of 2,000-lb. stamps in mills erected within the last few years. Changes in detail of battery construction have been necessitated by this progressive change in weight; exigencies of high stamp duty, requiring larger bin capacity, have also brought about modifications in constructional detail.

It would be impossible in the scope of this paper to deal with the many variations in stamp-battery construction to be found on the Rand. I shall consider only a few of the more important stages in progress, which have led to the introduction from America of the single-stamp unit, or Nissen stamp.

The first step in advance was the adoption by the Robinson Gold Mining Co. and others of 1,250-lb. stamps. This was the maximum until 1907, when a distinct impetus was given to a consideration of heavy stamps by the results of a series of trials conducted by the Consolidated Goldfields group under the direction of W. A. Caldecott. It was obviously desirable to ascertain the highest duty attainable from as heavy a dropping weight as could be sustained by an improved type of mortar box and concrete mortar block. It was apparent that an increase of duty would mean a corresponding decrease in number of units necessary, and, in consequence, lower initial and operating cost.

The Goldfields trials led to the installation of three large batteries of 1,550-lb. stamps, and more recent mills have adopted heavier weights up to 2,000 lb. Gradually timber-pile foundations were abandoned in favor of reinforced concrete, with or without the interposed anvil block. The stem and cam-shaft breakage attributed to this cast-iron base, and the higher cost of batteries using the anvil block, led to its abandonment in most of the more recent mills, although it still has its advocates. The accepted practice is now to bolt the mortar box direct to the concrete block by means of renewable bolts so arranged that they can be tightened while the battery is in operation. A cushion of hair felt or of sheet rubber, about ⅜ in. thick, is placed under the mortar box.

A notable departure from the standard type of battery construction was the case of the City Deep, Ltd., which in 1909 adopted reinforced concrete piers instead of king posts, and separate bearings between the cams, for a new battery of 2,000-lb. stamps. This design was intended to obviate cam-shaft breakage by affording greater bearing surface, and to insure better alignment, in view of the greater strain imposed upon the cam shafts by the heavy stamps. At the City Deep the concrete piers built up from the 10-stamp block support a single rigid steel casting, into which all the various parts of the usual battery superstructure are consolidated. The main feature of this casting is the heavy fish-bellied girders, with eight upward projections or fingers, terminating in cup-shaped bearings for the cam-shaft. Each 10-stamp shaft is thus given eleven bearings instead of the three usually provided. Theoretically, the innovation was sound, and ingeniously worked out. In practice, however, complications developed. It was found that a true alignment of bearing surface was practically impossible to maintain, without most troublesome and constant adjustment of the bearings themselves. Moreover, as the advantages of such a design were obviously dependent upon the integrity of the single ponderous casting, it was expected that this rigid frame would resist the enormous strain of continuous vibration. Unfortunately this casting in the course of time weakened, and developed fractures, requiring reinforcement and patching.

Following the City Deep installation, the old standard design of battery was reverted to and has been, with one exception, retained. In mills erected within the last five years we find the weight of stamps ranging between 1,550 lb., which some authorities reckon to be the conservative limit for combination of five units in a single mortar box, and 2,000 lb., which many regard as excessive weight, from the point of view of efficiency, convenience and cost of maintenance.

(To be continued).

MINING ACCIDENTS IN ONTARIO IN 1914

According to Mr. T. F. Sutherland, Chief Inspector of Mines of Ontario, there were during the year 1914 at the mines, metallurgical works, quarries, clay pits, and gravel pits regulated by the Mining Act of Ontario 54 fatal accidents, causing the death of 58 men. Of these, 28 causing the death of 29 men, occurred underground—a decrease of 8 as compared with the preceding year. The fatal accidents took place in mines operated by 23 different companies. At metallurgical works there was a marked decrease—4 fatal accidents causing the death of 5 men as compared with 11 fatalities during 1913. The number of fatalities at quarries shows an increase—14 fatal accidents resulting in 15 men killed, as compared with 8 killed in 1913, and one in 1912. The increase noted from year to year in the number of fatalities at quarries and clay and gravel pits is due to the fact that more complete returns are now being received from such works than formerly.

The total number of serious accidents in and about the mines of Ontario reported to the Bureau of Mines in 1914 was 359; resulting in 38 deaths and injuries to 328 persons. Of these accidents 282 occurred underground and 75 above.

At metallurgical works there were 104 accidents which caused the death of five men and serious injuries to 101.

At quarries there were 30 accidents, causing the death of 15 men and serious injuries to 16. It is evident that only a small portion of the non-fatal accidents at quarries is being reported to this Department.

In accordance with the Mining Act, inquests were held on all fatal accidents and attended by one of the inspectors.

The fatal accidents occurring in the mines were divided amongst the several districts as follows:

Gold mines of Porcupine and Kirkland lake	12
Silver mines of Cobalt and adjacent districts	11
Nickel-copper mines of Sudbury	9
Iron mines of Michipicoten	4
Iron pyrites mine, Western Ontario	1
Mica mine, Eastern Ontario	1
Total	38

It is interesting to note that the greater number of fatalities occurred during the first six months of this year as in 1913.

January, 1915, is the first month since August, 1911, in which there has not been a fatal accident in the mining industry.

On January 1st, 1915, the amendment to the Mining Act affecting cages and skips used for carrying men came into force. It is as follows (section 164, rule 32a):

All cages and skips used for lowering or raising men shall be constructed as follows:

(a) The hood shall be made of steel plate not less than three-sixteenths of an inch in thickness;

(b) The cage shall be provided with sheet iron or steel side casing not less than one-eighth of an inch in thickness, or with a netting composed of wire not less than one-eighth of an inch in diameter, and with doors made of suitable material;

(c) The doors shall extend at least five feet above the bottom of the cage, and shall be closed when lowering or hoisting men;

(d) The cage shall have overhead bars so arranged as to give every man an easy and secure handhold;

(e) The safety appliances shall be of sufficient strength to hold the cage or skip with its maximum load at any point in the shaft.

(f) The cage shall not have chairs attached thereto which are operated by a lever through or from the door.

The necessity for a regulation of this kind is seen from the number of accidents every year due to the light open-type cage in use at many Ontario mines. Care should be taken that the gate is kept in good repair and is so constructed that it cannot open outwards, thus avoiding all possibility of catching in the shaft timbers.

On January 1st, 1915, the Workmen's Compensation Act came into force.

The mining industry is included in Schedule I. Industries so classified are not individually liable. The Board levies an assessment and collects an accident fund, out of which the compensation to workmen is paid.

Compensation is paid on all accidents arising out of and in course of the employment, except:

1. Where the disability lasts less than seven days.

2. Where the accident is attributable solely to the serious and wilful misconduct of the workman and does not result in death or serious disablement.

The scale of compensation is as follows:

If the accident results in death and the workman leaves a widow but no children, the widow is entitled to a monthly payment of $20 a month.

If he leaves a widow and children the payment to the widow is $20 a month and $5 a month for each child under 16 years of age, not exceeding $40 in all.

If he leaves children only, the payment is $10 a month for each child under 16, not exceeding $40 in all.

If the workman was under 21 years of age and his dependents are his parents or one of them, such parents or parent will be entitled to $20 a month until the workman would have become 21 years of age, or for such longer time as the Board may determine.

In the case of other dependents they are entitled to a sum reasonable and proportionate to the pecuniary loss occasioned to them by the workman's death, as determined by the Board.

The necessary expenses of burial, not exceeding $75, are also in all cases to be paid.

All the above is governed, however, by the provision that in no case is the compensation to exceed 55 per cent. of the workman's earnings in the employment; and all provisions for compensation are subject to the proviso that no salary or wages of a workman shall be reckoned at more than $2,000 a year.

In the case of a widow who marries again the periodical payment ceases on her marriage, but she is entitled within a month after her marriage to a lump sum equal to two years' payments.

Where the accident results in total disability of the workman, he is entitled during the continuance of the disability, whether for life or temporarily, to a weekly or monthly payment equal to 55 per cent. of his earnings in the employment. Where the workman is only partially disabled he is entitled to 55 per cent. of the impairment of his earning capacity.

Where less than six workmen are usually employed in mining, including prospecting and development work, except in producing mines where the workmen are in the employ of the owner, lessee or recorded holder thereof, the industry is withdrawn from its class in Schedule I.

An industrial disease is considered a personal injury by accident, and a workman or his dependents is entitled to the regular scale of compensation. The most common industrial disease in mining is miners' phthisis.

Employers are required to give notice to the Board by registered mail of an accident within three days of its occurrence.

The rate assessed per $100 of payroll in mining and associated industries is as follows:

Mining	$3.00
Iron smelting	2.00
Concentrating, stamping or other preparations of metals or minerals (without heat)	.80
Reduction of ores (with heat), smelting or refining of other metals or minerals	1.50
Clay and gravel pits	2.00
Quarries	2.50
Railroads	6.00
Manufacture of explosives	10.00

The Compensation Act as it now stands is criticized by mine operators in connection with the following points:

Miners' phthisis is an industrial disease which, under ordinary conditions in Ontario would result only after several years' work underground. There is nothing in the Act to prevent a miner who has contracted this disease in another country moving to Ontario and taking advantage of the compensation paid by the Ontario Act.

The Act requires that all accidents be reported within three days. As compensation is paid only for accidents which incapacitate a workman for seven days, and as the majority of mining accidents do not disable a man for this period, the reporting of such accidents entails considerable unnecessary work.

The grouping of all the mines under one classification weakens the incentive to avoid accidents. Certain mines are necessarily more unsafe to work than others, and must in the long run have a higher accident rate. Within the past three years several mining companies in Ontario have by means of safety engineers, mine inspectors or safety committees gone to considerable expense in efforts to lower their accident rate; in every case these efforts have met with signal success. Nevertheless the safe mine or the careful operator has to pay the same rate as the unsafe mine or the indifferent operator. The result has been that since the Act came into force several companies have abolished their safety departments.

"GERMANS KNOW EVERYTHING AND UNDERSTAND NOTHING."

"The Germans have at Berlin the most complete bureau of information to be found anywhere in the world. They know everything and understand nothing. They had no measurement in Germany to gauge the soul of a nation such as that of the British Empire," declared Mr. C. W. Barron, in his address before the Montreal Canadian Club.

NIPISSING.

The following is a brief financial statement of the affairs of the Nipissing Mining Co. Ltd., (the Operating Company) as of April 1st, 1915. Cash in Bank $547,590.43; Bullion in transit $264,057.21; Ore on hand and in proces and bullion ready for shipment $577,664.31; Total $1,389,311.95.

DISASTER AT BRITANNIA MINES, BRITISH COLUMBIA

The loss of more than fifty lives at the Britannia Mining and Smelting Co.'s copper mines on Britannia mountain, near Howe sound, British Columbia, resulted from a slide of snow and rock which occurred soon after midnight of Sunday, March 21. On April 1 it was stated that 34 bodies had been recovered and 19 persons were reported missing. In addition, 24 persons were known to have been injured—two dangerously and about ten seriously, the others having escaped with only slight injuries. As there is still in the valley at and below the site of the old camp much snow and debris, the work of finding the remaining dead bodies is slow, and hydraulicking has been resorted to in order to facilitate operations.

The group of mineral claims on which the Britannia Co. has opened several mines is situated in the mountains of the Coast range east of Howe sound, about 20 miles directly north from Vancouver, and 28 miles by water, following the Coast line from that city. Howe sound is an irregular fiord, cutting well back into the Coast range, and is bordered along its whole length by rugged mountains and high ridges. The mine now being worked is in the steep mountain-slope covered by the company's Fairview claim. This ridge separates Britannia creek from Furry creek; it is about 4,300 ft. in height. The principal workings are in the north slope of the ridge at a distance of three and a quarter miles from the coast and at an elevation of from 3,275 to 3,775 ft. above sea-level. The Fairview mine is opened by six adits ranging from 100 to 250 ft. between levels, with connecting raises from what is known as the 1,050 ft. level, which is practically at the level of the mine camp, up to the 250 ft. or highest level. All ore from above the 1,050 ft. has been dropped down the raises to that level, and hauled thence by a 3-ton electric locomotive to the rock-crusher at the upper terminal of an aerial tramway the length of which is 5,800 ft. down to a reloading or transfer station at 1,400 ft. lower elevation, and thence 11,000 ft. to the concentrating mill at Britannia Beach near sea-level, which is about 1,900 ft. still lower.

During the last two or three years important improvements have been made with the primary object of overcoming difficulties attendant upon surface operations at the higher level of the upper camp where deep snow impedes outdoor work in winter, and of enlarging the transportation facilities. A crosscut adit, known as the 2,200-ft. level, starting at a short distance from the intermediate station of the aerial tramway, has been driven 4,336 ft. into the mountain, and from it an 8x12 ft. rock-raise has been holed through to the 1,050 ft. level above; a three-compartment shaft, outside measurements 10x20 ft., commenced at 3,922 ft. in from the portal of the new adit, is now less than 190 ft. from the 1,050 ft. level. On completion this will be the chief connection between the old workings above and the 2,200-ft. level, and the latter will be the main outlet from the mine. Haulage thence will be by electric locomotives over the three and a half miles of sidehill railway to the head of a double-tracked incline, 5,500 ft. long, and of an average grade of approximately 30 per cent., down to the concentrating mill at 1,600 ft. lower elevation. These late improvements, however, are not yet available for mine use, so the aerial tramway will for some time longer remain

the chief means of transportation, at any rate between the transfer station and Britannia Beach.

Concerning the recent slide and its disastrous results—it appears that a great mass of snow, rock, and earth slid down from one of the mountains above the camp. It probably was started by the breaking away of part of the face of one of the big bluffs of rock, above the 1,050-ft. level of the Fairview mine, the outlet of which was the snow-shedded tramway thence to the rock-crusher at the upper terminal of the aerial tramway. Coming down at a right-angle to the narrow valley in which the camp was situated the slide turned sharply to the left and then through the camp, carrying away much of the covered tramway, the cookhouse, one bunkhouse, office, store, hospital, clubhouse, electrical shop and transformer house, crusherhouse, tramway terminal, and seven dwellings. Fortunately two bunkhouses and several dwelling houses escaped the general ruin. One end of the mine superintendent's house was broken away, and some of the rooms partly filled with snow and debris, but the family were unhurt. Then the slide turned down Jane creek and continued on to Britannia creek, stopping within 200 ft. of the outlet of the new adit forming the 2,200-ft. level. The total length of the slide has been stated in an official report to have been 4,300 ft., and the difference in altitude between its starting point and where it stopped about 1,900 ft.

The number of persons known to have been living in the upper camp two or three days before the disaster occurred was 163, this total including 137 men, 15 women, and 11 children. Of these, it seems that 77 (including some of the women and children) either lost their lives or were injured. The others were men on night-shift in the mine or asleep in one or other of the two bunkhouses that were untouched, or were in dwelling houses situated out of the pathway of the slide. Sensational newspaper stories have given grossly exaggerated details, but the officially reported facts are as above stated. At one time, prior to the outbreak of the European war, the Britannia company had fully 700 persons on its payroll, but this number included all employees at the mill and other works at Britannia Beach, all on railway and other construction work between the Beach and the new adit, those employed at the new camp at Halfway, and those engaged in development work at the new adit, as well as all in and about the mountain camp that was destroyed, but the total number of employees during recent months has been between 500 and 800.

For years the company has had at Britannia Beach its own well-equipped hospital, with resident doctor and trained nurse, and a smaller hospital at the upper camp with another doctor there. It has also paid a prominent surgeon resident in Vancouver City a regular retaining fee so as to have his services in special cases when required. During recent months it purchased three pulmotors, and only a few days before the disaster occurred a provincial government official was at the property giving instruction in the use of this modern automatic reviving apparatus.

One result of the recent fatal experience will be the hastening of the previously-decided practical abandonment of the upper camp, for now the big shaft connection between the 2,200 and 1,050 ft. levels will be completed with all expedition, the construction of the incline from the lower end of the railway down to the concentrating mill (which work is already well advanced) will be finished, and the heavy machinery (much of which is now on the ground) to be used in connection with the crushing of ore and its delivery to the electric trains for conveyance to the head of the incline, will be put in as soon as possible, so that ore-production may be resumed and the intended enlargement of output be carried into effect. Much of this new work would have been done last autumn and winter had it not been for the partial suspension of operations necessitated by the war, and in that case there would probably have been only a comparatively small number of residents in the old mountain camp. However, no human foresight could have averted the recent calamity, of which there was no warning.

STEEL COMPANY OF CANADA.

The experience of the Steel Company of Canada during 1914 was the experience of the steel industry generally throughout the United States and Canada. It's the old, old story as put down by Andrew Carnegie: "The steel industry is either prince or pauper."

Stimulated by war orders the company looks forward to a profitable 1915 however. Mr. C. S. Wilcox, in his report prepared for the shareholders' meeting on April 29, says in this regard "Since the close of the year we have received some large orders for materials required for the British and Home Governments. These orders will keep some of our departments well employed for a number of months."

The results of the year's operations were net profits of $539,811 after expending $341,587 for repairs, maintenance and improvements on plant and machinery. Though the preference dividend was only paid for the first half of the year the deficit was run up to $313,172. There was a deficit of $85,802 before the dividend was even met. This compares with earnings at the rate of 14.7 per cent. on the preference stock in 1913 and 14 per cent. in 1912.

In his report Mr. Wilcox, the president, says: "The Conditions of trade during 1914 bore heavily on the steel companies in both Canada and the U. S., as shown by the various financial reports which have already been published. The practical cessation in all activity in railway building, in the manufacture of agricultural implements and cars of all kinds, of municipal and other construction work, etc., cut deeply into the production of rolled bars and pig iron which are our heaviest tonnage lines.

"The first five months of the year were particularly dull, but in June and the early part of July a fair increase was noticed, but at the outbreak of war business was entirely disrupted; many desirable orders which we had on our books were cancelled in whole or in part. With the falling off in demand there followed, as a natural sequence, a decline in prices.

"To meet the decrease in earnings every effort was made to reduce expenses. Both adminstration and operation forces were brought down as early as possible to the lowest point, consistent with the best interests of the company.

"It will be observed from our financial statement that while we have increased the amount of our reserve funds by $53,640.18, nothing has been written off for depreciation. There was, however, a considerable sum spent in extraordinary repairs and improvements. In reducing our forces, we had to bear in mind that we could not afford to destroy our organization by laying off all skilled men. The time of these men was fully occupied in making the repairs and improvements above mentioned, with the result that all our plants are to-day in a high state of efficiency."—Financial Times.

NIPISSING MINING COMPANY, LIMITED, ANNUAL REPORT, 1914

Mr. R. B. Watson, general manager, submits the following report of operations of the Nipissing Mining Company, Ltd., for the year ending Dec. 31, 1914:

Shipments in 1914.

	Dry Tons	Fine Silver Ounces	Net Value	Per Cent. of Total Net Value
Silver Bullion, including Bullion produced from Custom Ore	216.5970	6,300,177.23	$3,431,853.43	155.82
Cobalt Residue, including Residue produced from Custom Ore	1,060.6290	34,452.62	42,344.06	1.92
Second Grade Ore	4.9105	1,066.72	627.31	.03
Total shipments	1,282.1365	6,335,696.57	$3,474,824.80	157.77
Less Custom Ore	847.9241	2,335,834.06	1,272,424.18	57.77
Shipments of Nipissing Product	434.2124	3,999,862.51	$2,202,400.62	100.00%

Summary of Shipments, 1914.

Nipissing Production Only.

Dry Tons Shipped	434.2124	Received from sales of Cobalt	$6,568.08
Gross Ounces Silver Contained	3,999,862.51	Gross Silver and Cobalt Value	$2,221,194.68
Gross Silver Value	$2,214,626.60	Marketing Charges	18,794.06
Average price received per ounce—cents	55.365	Net value received from sales	2,202,400.62

Production in 1914.

	Dry Tons.	Ounces Silver	Gross Value	Net Value
Shipments in 1914	434.2124	3,999,862.51	$2,221,194.68	$2,202,400.62
On hand at Mine, Dec. 31, 1914	206.9650	1,110,272.15	538,481.99	523,913.03
	641.1774	5,110,134.66	$2,759,676.67	$2,726,313.65
On hand at Mine, Dec. 31, 1913	129.4210	420,801.62	243,619.81	239,515.37
	511.7564	4,689,333.04	$2,516,056.86	$2,486,798.28
Difference between estimated shipments in 1913 and actual returns	....	....	7.99	7.99
Nipissing production	511.7564	4,689,333.04	$2,516,064.85	$2,486,806.27

Cost of Producing Silver, Nipissing Mining Co.

Based on production of 4,689,333.04 oz. and 80,037 tons milled.

		Per Ton Ore	Per Oz. Silver
Hydraulicking	$ 46,578.98	$ .582	$.0099
Diamond drilling	3,005.00	.037	.0006
Development and exploration	220,799.48	2.759	.0471
Stoping	136,326.32	1.703	.0291
Loading and shipping ....Cr.	1,628.53	.020	.0003
Assaying and engineering	11,571.54	.144	.0025
Administration and office	27,611.09	.345	.0059
Boarding house and camp maintenance	20,719.94	.259	.0044
Insurance and taxes	37,443.67	.468	.0080
General and legal	23,877.10	.298	.0051
High grade mill	36,327.17	.454	.0077
Low grade mill	315,650.59	3.944	.0673
Depreciation	54,242.41	.678	.0116
Marketing product	24,894.48	.311	.0053
Corporation, New York office and traveling	13,692.29	.171	.0029
	$971,111.53	$12.133	$.2071
Less rents and interest	42,667.84	.533	.0091
Total cost of production	$928,443.69	$11.600	$.1980

Summary of Production.

Gross Value of Production	$2,516,064.85	100.0%
Total cost of production	928,443.69	36.9%
Difference	$1,587,621.16	63.1%

Total Shipments to December 31, 1914.

	Dry Weight Pounds	Gross Ounces Silver	Gross Value Silver plus Cobalt, Nickel and Arsenic paid for	Net Value Received
1904	124,659	32.13	$24,163.90	$23,887.52
1905	939,373	753,153.90	505,638.28	471,666.61
1906	4,019,494	2,214,821.60	1,576,852.94	1,421,655.54
1907	4,804,426	2,239,551.89	1,373,088.57	1,234,492.35
1908	7,009,998	2,893,031.44	1,526,686.32	1,364,478.03
1909	12,825,169	4,646,869.21	2,417,767.21	2,180,407.02
1910	13,388,039	5,596,135.80	3,008,957.80	2,742,842.58
1911	5,829,254	4,678,074.14	2,507,196.98	2,381,712.54
1912	3,701,726	4,719,578.21	2,893,276.54	2,827,317.62
1913	2,657,250	4,844,169.41	2,945,335.30	2,920,714.26
1914	868,425	3,999,862.51	2,221,194.68	2,202,196.62
	56,167,813	36,585,280.24	$21,000,158.52	$19,771,370.69

Dividends Paid to December 31, 1914.

		By Nipissing Mining Co., Ltd.	By Nipissing Mines Co.
1905	To Syndicate	$300,000.00	
1906	" "	100,000.00	
	To Nipissing Mines Co.	500,000.00	$480,000.00
1907	" " " "	880,000.00	840,000.00
1908	" " " "	740,000.00	720,000.00
1909	" " " "	1,370,000.00	1,350,000.00
1910	" " " "	2,122,500.00	2,100,000.00
1911	" " " "	1,853,430.49	1,800,000.00
1912	" " " "	1,842,366.76	1,800,000.00
1913	" " " "	1,835,000.00	1,800,000.00
1914	" " " "	1,380,000.00	1,350,000.00
		$12,923,297.25	$12,240,000.00
Dividend declared Dec. 21, 1914		310,000.00	300,000.00
		$13,233,297.25	$12,540,000.00

Sources of Production.

	Tons	Tons
From Underground—		
Shaft 73	53,719	
Little Silver	7,493	
Shaft 122	4,811	
H-52	5	
		66,028
From Dumps—		
Vein 80	13,231	
Vein 96	128	
Vein 122	653	
		14.012
		80,040
Less 1.70% moisture		1,363
Total production		78,677
High Grade Ore and Concentrate Produced		1,028
Low Grade Ore to Battery Bins		77,649

Production of Individual Veins in 1914.

	Silver Ozs. in High Grade Ore	Silver Ozs. in Mill Rock	Total Silver Ozs.
Shaft 73—			
Veins 73, 80, and 100	1,968,243	1,890,298	3,858,541
Vein 96		3,616	3,616
Vein 122	176,358	154,342	330,700
Little Silver	274,577	211,514	486,091
H-40 and H-52	9,131	1,254	10,385
	2,428,309	2,261,024	4,689,333

High Grade Mill.

There have been no additions to the high grade plant during the year and no change in treatment.

The mill treated 929 tons of Nipissing ore having an average value of 2,439 oz. per ton, and 965 tons of custom ore averaging 2,421 oz. per ton. In addition to this, the refinery treated the precipitate from the low grade mill. The total shipments of bullion during the year amounted to 6,300,177 fine oz.

The market for Cobalt nickel residue was good during the first half of the year, but since the war started all foreign consignments have been cut off.

Total shipments of residue amounted to 1,060 tons, which gave a net return of $42,344.06.

Bullion and Cobalt residue were the only products shipped by the company during the year.

Experiments are now being conducted with the Cottrell process on the fumes from the furnaces, the object being a possible further saving of silver and mercury.

Low Grade Mill in 1914.

	Dry Tons.	Assay Ozs.	Silver Ozs.
Ore Treated	79,009	30.82	2,435,345
By-products Treated	116		87,081
Total milled	79,125		2,522.426
Bullion recovered from the above			2,261,024
Actual extraction by clean-up			89.64%

The low grade ore averaged 3.6 oz. per ton higher than in the previous year and the mill treated 1,885 tons more.

Research work on the low grade mill operations proved that practically all the rock in the final tube mill discharge will pass a 200 mesh screen, but that the metallics in the ore are flattened out and remain on the screen. Two Callow screens were therefore installed in the tube mill circuits and these are now recovering from 20 to 25 per cent. of the total silver in the ore. The dirty metallics from the screens are cleaned on a Wilfley table and the product is melted into bullion. It is expected that this preliminary treatment will lower the cost in the cyanide plant and increase the extraction.

Consumption of Supplies at Low Grade Mill.

	Lbs.	Lbs. Per Ton	Cost Per Lb.	Total Cost Per Ton Ore
Cyanide	421.813	5.331	$.1555	$.8292
Lime	454,876	5.749	.0042	.0242
Caustic Soda	242,014	3.059	.0211	.0647
Aluminum Dust	46.836	.592	.3382	.2002
Aluminum Plates	41,858	.529	.2467	.1305
Aluminum Ingots	13,586	.172	.1925	.0331
Flint Pebbles	302,695	3,826	.0084	.0331
Coal for Heating	2,532,100	32,001	.0029	.0933
Power, K.W.H.	4,264,000	53,889	.0117	.6384
				$2.0457

Forty stamps ran 329.17 days or 89.12 per cent. of possible running time. Crushed per day 240.38 tons; crushed per stamp per day 6.01 tons.

Nipissing Treatment Costs.

Including Transportation, Picking Plant, Low Grade Mill and Construction. Based on 79,125 Tons Milled.

	Total Cost	Cost Per Ton
Crushing at mine	$10,124.44	$ .128
Aerial tramway	5,142.23	.065
Surface tramway	5,469.79	.069
Picking plant	16,118.17	.204
Crushing and Conveying	3,804.73	.048
Battery	21,782.20	.275
Tube Mills and Classifiers	45,457.57	.575
Desulphurizing and Slime Collecting	24,093.68	.304
Intermediate Filtering	8,776.46	.111
Cyanide Treatment	85,130.68	1.076
Cyanide Filter	10,892.15	.138
Clarifying and Precipitation	22,819.56	.288
Refining	8,785.21	.111
Heating	9,317.46	.118
Water Supply	2,878.40	.036
Construction	26,437.33	.334
Residue Dam	4,632.97	.059
Consulting	3,987.56	.050
	$315,650.59	$3.989

Notwithstanding the increase in the cost of cyanide and other supplies, the total cost of treatment was $.14 per ton less than in 1913.

Nipissing Surface Prospecting.

The hydraulic plant was moved from Cobalt Lake to Peterson Lake and nearly all the ground draining into Peterson and Cart lakes from the west was washed clear of soil.

Acres washed, 95.55; cost per acre, $499.47; cost per cubic yard, 9.01c., made up of: labor, 4.99c.; power, 3.20c.; supplies, .82c. Average depth of soil, 3.43 ft.; 153 set-ups made; 34,540 ft. of 16 in. pipe taken up and 33,769 ft. laid down; 18,730 ft. of roads built; average pressure at nozzle, 138 lb.; pump ran 79 per cent. of possible running time.

The area washed had been previously trenched, but it was largely conglomerate and was thought to be as promising as any ground we have. The results were not as good as expected; the only vein of importance found was H-52, from the outcrop of which 10,000 oz. in high grade ore was taken. This vein will be opened up next summer.

Several diamond drill holes aggregating 1,159 ft. were put down on the eastern side of Peterson lake without favorable results. One hole near the edge of the lake showed 300 ft. of diabase, then 38 ft. of slate lying on top of the Keewatin.

Summary of Underground Work, Nipissing Mine, 1914

Shaft No.	Drifting Feet	Cross-cutting Feet	Raising Feet	Sinking Feet	Total Feet	Stoping Cubic Yards
63	479.5	172.0	14.0		665.5	4,578
64	596.5	708.0	31.5	215.5	1,551.5	
73	3,014.0	2,358.5	1,205.5	273.0	6,851.0	20,418
80						754
86	532.5	553.5	113.0		1,199.0	
122						348
150	256.0	1,376.5	195.0		1,827.5	
H—40				53.0	53.0	
H—52						253
Total	4,878.5	5,168.5	1,559.0	541.5	12,147.5	26,351

Development.

The 12.148 ft. of development compares with 13,665 ft. done in 1913. Stoping was very much less—26,351 cubic yards compared with 44,018 cubic yards during the previous year. The tonnage of ore broken down and ready for hoisting was increased, however, from 65,393 tons to 75,806 tons. A large part of the ore produced came from development.

Shaft 63.—The only work done from this shaft was the development and stoping of the Little Silver veins, which gave very satisfactory results. Two stopes were carried up from the 175 ft. level toward the surface; one of these broke into the old tunnel workings.

The reserves amount to $655,065 oz., most of which is in broken ore in the stopes.

Shaft 64.—This vein, which is the largest and strongest fissure on the Nipissing property, has been prospected to a depth of 1,065 ft. on the dip of the vein. Several valuable ore shoots were opened up in the conglomerate above the 275 ft. level, but they did not extend into the underlying Keewatin. As the vein was strong and carried low silver values throughout, it was considered advisable to explore it at depth and the main shaft was therefore sunk to the 902 ft. level. A crosscut 272 ft. long was necessary in order to reach the vein, which was then drifted on for 454 ft. From this level an inclined winze was sunk and 53 ft. of drifting was done on the lowest level, which has a vertical depth of 1,003 ft. from surface, making it the deepest working in the Cobalt district.

All this work at depth failed to develop any pay ore; the vein, while narrower, is still strong, but only assays from 5 to 20 oz. silver.

The third levels of shafts 64 and 73 have been connected by a crosscut; all ore hereafter will be hoisted through shaft 73.

Shaft 73—The vein system at shaft 73 continues to be by far the most important part of the company's resources. More development work was done here than on all the rest of the property together and the shaft produced 80 per cent. of the ore hoisted.

The main 73 ore shoot has consistently followed down the conglomerate Keewatin contact, the ore occurring entirely in the upper formation. The bottom of the main orebody has been definitely determined throughout its entire length by the developments along the contact between the third and fourth levels.

On the third level, however, a number of branch veins were opened up, which by turning off nearly at right angles to the main vein, continued in the conglomerate formation. These branches proved of much importance and on one of them, known as No. 98, an ore shoot 575 ft. long has been developed on the fourth level.

From this vein in turn, five new branch veins have been opened up on the fourth level and these promise well for the future. In fact, the fourth level results for the year have been most satisfactory. Three winzes sunk below the fourth level have located the Keewatin at a depth of from 50 to 70 ft.

A new shaft was raised from the fourth level to the surface at a point close to our eastern boundary, and this has improved working conditions materially by giving good ventilation throughout the mine and providing another outlet for waste rock.

The stoping of the branch veins and of the main vein has been almost completed above the third level, much of this ore being still in the stopes ready for the mill. Drifting on the various veins on the fourth level provided a large part of the ore sent to the mill during the year.

The ore reserves at 73 shaft consist of 3,103,685 oz. in high grade and 1,747,020 oz. in mill rock.

Shaft 80.—The only work done at this shaft was a small amount of stoping on 80 vein. The reserves in 80 and 100 veins consist mostly of broken rock in the stopes and amount to 1,841,000 oz.

Shaft 86.—This shaft is situated on the west side of Cart lake and serves for the development of veins 86, 88, 89, 99 and 146. Some 1,200 ft. of work was done on these veins. The high grade ore developed is of small consequence, but there will be a fair production of mill rock from this shaft.

Shaft 122.—The remaining ore in vein 122 was broken down, the stopes were drawn off and all work in this shaft discontinued.

Shaft 150.—We have continued to explore through shaft 150, the tract of conglomerate on the east side of Cart lake. The work has consisted of crosscutting on the first, second and third levels, drifting and raising on three calcite veins. So far this work has been unsuccessful, though the formation is favorable and good orebodies have been opened up on adjoining properties. Some further work on this ground is planned for the coming year.

H-40 and H-52.—These veins were uncovered by the hydraulic operations during the year and some 10,000 oz. of silver was taken from the outcrop; they will be developed underground during the coming season.

Nipissing Ore Reserves, December 31, 1914.

Developed and Partly Developed Ore.

Shaft No.	High Grade Ore Tons	High Grade Ore Ounces	Mill Rock Tons	Mill Rock Assay	Mill Rock Ounces
73	1,900	3,103,685	87,351	20	1,747,020
64	230	240,303	5,507	20	110,140
80	269	628,750	12,722	25	318,050
100	260	609,400	11,392	25	284,800
63	165	452,700	8,301	24.4	202.365
	2,824	5,034,838	125,273	21.3	2,662,375
Dumps			97,337	23.8	2,319,863
			222,610	22.4	4,982,238

Summary.

	Tons	Assay	Ounces
High Grade Ore	2,824	1783.	5,034,838
Mill Rock	222,610	22.4	4,982,238
Total	225,434		10,017,076

Summary of Results, Nipissing Mining Co., 1914.

Although the price of silver has been very low since July, the result of the company's operations during the past year has been most satisfactory.

The mine produced 4,689,333 oz. of silver at a cost including every expense, of 19.8 cents per oz. This compares with a production of 4,552,173 oz. at a cost of 24.09 cents during the previous year. The working charges were reduced from $14.19 to $11.60 per ton of ore.

The net return was $1,587,621.16 as against $1,660,271.44 in 1913; this falling off is due to a drop in the price received for silver from 60.261 cents in 1913 to 55.365 cents in 1914. Dividends declared during the year amounted to $1,235,000.

Both the high grade mill and the low grade mill worked at full capacity throughout the year and at a less cost per ton of ore treated. The production was about equally divided between high grade ore and low grade mill rock. A larger amount of custom ore than usual was treated by the high grade mill, the total shipments of bullion from the refinery amounting to 6,300,000 fine oz.

Considerable work is being done on the Teck-Hughes mine in the Kirkland Lake district, for which expenditures the Nipissing Company is receiving treasury stock of the Teck-Hughes Company. A number of other outside properties have been investigated, but no interests acquired.

The developments underground during the year were exceptionally good. The reserves, which now stand at over ten million ounces, are the largest ever shown by the company. This amount is assured and the past history of the company and the present bright outlook make us confident that future developments will show their usual good results.

Treasurer's Report.

Statement of Operations, Dec. 31, 1914.

Gross Settlements 1913 Ore (paid for in 1914)		$191,212.66
Gross Settlements 1914 Ore		2,914,888.29
Gross Settlements for year		$3,106,100.95
Gross Value of Ore and Bullion at Mines and in Transit December 31, 1914		1,129,539.58
		$4,235,640.53
Less:		
Gross Value of Custom Ore purchased	$1,284,751.20	
Gross Value of Inventory, December 31, 1913	434,824.48	
		1,719,575.68
Gross Value of 1914 Ore		$2,516,064.85
Other Receipts:		
Ground Rents	$20,157.50	
Interest, Discount, etc.	22,510.34	
		42,667.84
		$2,558,732.69

Cost of Mining and all other expenses (including Smelter Deductions, Treatment, etc., on Settlements 1914 Ore and Accrued Charges on Ore and Bullion at Mine and in Transit)		971,111.53
Net Receipts for 1914 Production		$1,587,621.16
Cost of Special Investigations		8,905.92
		$1,578,715.24
Surplus, January 1, 1914		1,259,060.96
		$2,837,776.20
Less:		
Dividends declared and paid during 1914	$935,000.00	
Dividend payable January, 1915	300,000.00	
		1,235,000.00
Net Surplus to Balance Sheet		$1,602,776.20
This Net Surplus is made up as follows:		
Cash in various banks		$391,291.64
Ore and Bullion at Mines and in Transit		1,129,539.58
Accounts receivable		25,058.35
Investments		69,519.61
Mining Plant, Equipment and Supplies		496,886.75
		$2,112,295.93
Less:		
Accrued Expenses on Ore and Bullion not settled for	$18,997.47	
Accounts Payable (including estimated Taxes)	190,522.26	
Dividend Payable January, 1915	300,000.00	
		509,519.73
Net Surplus		$1,602,776.20

Balance Sheet, Dec. 31, 1914.

Assets.

Mining Property	$250,000.00
Mining Plant, Equipment and Supplies	496,886.75
Investments	69,519.61
Ore and Bullion at Mine and in Transit	1,129,539.58
Accounts receivable	25,058.35
Cash in Banks, New York, Toronto and Cobalt	391,291.64
	$2,362,295.93

Liabilities.

Capital Stock	$250,000.00
Accounts Payable, including estimated Taxes	190,522.26
Accrued Expenses on Ore and Bullion	18,997.47
Dividend Payable January, 1915	300,000.00
Surplus (See Statement of Operations)	1,602,776.20
	$2,362,295 93

WAR ORDERS.

Dunkirk, N.Y.—Official confirmation is given out by Vice-President James McNaughton of Brooks plant of American Locomotive Co., of the award of contracts by European allies for 2,500,000 shells, the total value of the contracts aggregating $40,000.000. American company was lowest bidder for the work, and one of the principal specifications is prompt delivery. In order to facilitate execution of the big order it will be necessary to instal nearly $1,000,000 worth of new machines. Contracts given by the Russian and English governments figure close to $70,000,000, part of which went to the New York Air Brake Co., and the Westinghouse Co.

The capacity of the Dunkirk plant will be 3,000 shells a day and at Montreal 1.000 will be turned out daily. The work will require the running of the Dunkirk plant night and day for two years.

It is provided that in case of the war coming to an end full payment shall be made on account of the expense to be incurred in the installation of machinery. The Brooks plant has been running at one-fifth capacity for a year.

Pittsburg.—Crucible Steel Co. has booked a war order valued at $20,000,000. The report that the company had closed this contract was accompanied by an advance in stock on Saturday to 20, up 4 points.

New York.—The past week, while it brought few new contracts for war material, saw publication of many additional details of business already in hand, or for which contracts were about to be signed. The magnitude of this business has become more evident as details have come to light, and stocks of companies which have contracts for war material have continued to be the center of speculation.

"Shrapnel" has been a word to conjure with. Estimates of orders for this material are always expressed in at least eight figures. Equipment companies, most of whose machinery has long been idle, have put their boring machines to work on shrapnel instead of engine cylinders. Contracts closed or about to be closed by American Locomotive Co. are estimated all the way from $30,000,000 to $75,000,000. Interests close to the company place the total at $65,000,000. This material is for the Russian government, and the company's contract insures it against loss of profits in case of the ending of the war.

T. M. Latimer of Pittsburg, according to despatches, has practically closed contracts which will amount to $35,000,000 for munitions of war and other material. Empire Trust Co. of New York is in charge of the contracts.

Other concerns which have figured in the shrapnel business are New York Air Brake Co., with orders estimated at $30,000,000; Lackawanna Steel, Carnegie Steel and Crucible Steel, Westinghouse Air Brake, said to have a $20,000,000 shrapnel contract with France, and American Car & Foundry. Chicago despatches say American Steel Foundries Co. has gotten a share of the big order being distributed to American equipment concerns. E. W. Bliss Co., Brooklyn, turning out 30,000 shrapnel shells a day, is building a third addition to its plant, it is reported. Details of order placed with Canadian Car & Foundry Co. are to effect that the contract calls for 2,500,000 explosive and 2,500,000 shrapnel shells, the whole contract calling for more than $80,000,000. The first order for 2,000,000 will be completed this year and the balance will be ready by the end of January, 1916, according to a statement issued by Nathaniel Curry, president of the company. The Standard Steel Car Co. is about to start work on a big order for shells.

Other similar business is an order for 60,000,000 cartridges—more than a year's output—taken by United States Cartridge Co. from Great Britain.

Studebaker Corporation within 10 days has booked about $3,000,000 of additional war contracts for harness and vehicles. Previous orders of this company amounted to something like $14,000,000.—Boston News Bureau.

STUDENTS ENLISTING.

Enlistment at the Universtiy of Toronto, instead of falling off with the approach of spring, has increased, and each day the registrar's office is besieged by new applicants. The latest list, which, however, lacks about fifty names, shows the following number of men on active service:

Graduates—Officers, 187; in rank, 119.

Undergraduates—Officers, 60; in ranks, 275.

Staff—Officers, 34; in ranks 5.

To this must be added about 100 students and members of the staff who are in the base hospital.

The Officers' Training Corps is now idle, awaiting news of their ten-day encampment at Niagara. If the camp idea is set aside, it is said the corps will disband for the summer.

A LARGE ELECTRIC HOIST AT HAMILTON, ONT.

An electric hoist of unusual size with many interesting automatic safety devices was recently installed by the Hamilton Mountain Park Co., Limited. Although the incline on which it is used to raise and lower cars is called a railway, this apparatus is really a development of a mining hoist on a very large scale and with special reference to the demands upon it. The difference in elevation between the general level of the city and the country at the top of the mountain is about 325 ft. Originally a steam hoist was used to transfer waggons, automobiles and passengers. This became inadequate to handle safely and quickly the ever increasing traffic, and the company, of which Mr. George F. Webb is president, gave to the Canadian General Electric Co. a contract for an electric hoist to take its place.

A special double fixed drum double geared electric incline hoist, built by the Lidgerwood Manufacturing Co., of New York, operates two cars in balance on an incline 800 ft. long, with a grade of 40.27 per cent. Each car weighs 30,000 lbs. and runs on tracks having a gauge of 12 ft. 1½ in., the centre to centre of tracks being 20 ft. 3 in. The average load on the cars will be about 20,000 lb., with a maximum load of 30,000 lb. The hoist arrangement is suitable for either hoisting the maximum load with empty car descending, or for lowering the maximum load with the empty car ascending.

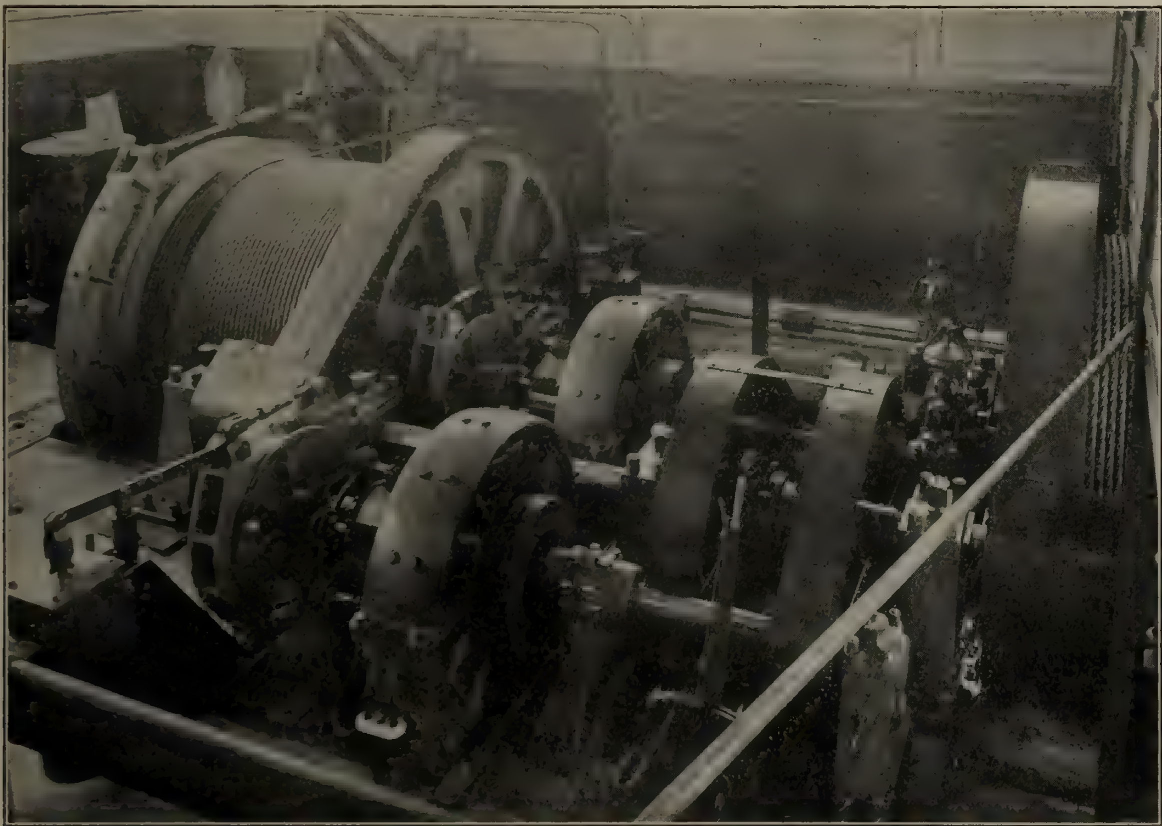
The time required for making a single trip is 1½ minutes, and the rest period between trips 3 minutes. Attached to each car are two ropes of 1⅝ in. diam. each rope weighing 4.15 lb. per ft. One of these ropes is used for hauling the car, and the other for the purpose of safety. The average rope speed during the run is 585 ft. per minute.

Hamilton Mountain Park Incline.

Incline arrangement.—The hoist is located in a house 106 ft. from the knuckle between the incline and the level of the summit. The main rope from the right hand car is wound over the top of the right hand hoist drum. The main rope from the left hand car is wound underneath the left hand hoist drum. The safety rope from the right hand car is led over suitable deflecting sheaves to the top of the left hand drum, and the safety rope from the left hand car is wound over suitable deflecting sheaves to the bottom of the right hand drum Each of these sheaves is 7 ft. diameter to the bottom of the rope groove and weighs 3,500 lb. There are four head sheaves and four deflecting sheaves. The head sheaves are arranged vertically so as to carry the hoist ropes and safety ropes in a direct line from the cars, the deflecting sheaves are placed horizontally at such an angle that the rope will be led in a direct line to either the top or bottom of the hoist drums, as the case may be. Floating sheaves are also furnished to guide the ropes and are placed in the rope tunnels between the head sheaves and the hoist drums.

The reason for reeving the safety ropes as outlined above is that in case of an accident to the left hand side of the hoist the safety rope on the left hand car would take care of it properly, being wound on the right

hand drum; the same thing would apply if the other drum of the hoist should become disabled, that is, the main ropes and the safety ropes from each car lead to opposite drums. Further advantage is gained by the fact that each drum is equipped with an independent double acting brake, and in case either of the main ropes should break, the safety rope will hold the cars. Furthermore, the safety rope, if called upon to take the load, will be controlled by all the automatic brake features in exactly the same manner as when the load is being handled by the main ropes. In actual operation the length of the safety ropes will be slightly more than that of the main hoist ropes, thereby relieving the safety ropes of any hoist stresses other than those required to keep the ropes themselves in motion.



Hamilton Mountain Park electric hoist, showing both motors, solenoid brakes and fly ball governor speed limit safety device.

Operation and safety appliances.—The operator's cabin is fitted with one electric control and two hand brake levers. The levers will not be used ordinarily as the hoist is equipped with solenoid brakes operating on the motor shaft. The hand brakes, therefore, need only be used for the locking of the cars at the top and bottom positions or for cases of emergency. In starting a run, the operator releases the drum post brakes by the hand levers, puts his foot on the small foot pedal located at bottom of master controller and moves the handle of the controller to either the right or the left as the case may be. The cars will start and will automatically accelerate to the normal rope speed. At a predetermined point on the incline, the controller handle will be automatically turned to such a position that the speed will be cut down to 1-10 of the normal and finally be turned to the off position, thus setting the solenoid brakes and bringing the cars to rest.

Should the operator become disabled during a run, he will of necessity remove his foot from the foot pedal thereby cutting off the current, bringing the cars to rest. In order for the cars to move, the operator's foot must be on this pedal. In case the cars should stop short of their landing positions due to the automatic overwinding mechanism, there are available two or three points on the controller so that the operator can bring them to their proper positions. Should the cars fail to stop due to the fault of controller, an attached overwinding device will shut off the current and set the solenoid brakes. Should the speed of the cars exceed the normal by a predetermined amount an overspeeding device will trip a weight of 570 lbs. which will set the drum post brakes. This overspeeding device or governor is of the fly ball type, and it will be caused to operate by an excessive speed, whether due to motor or a breakage of the hoist parts. The emergency weight may also be tripped manually from the cabin.

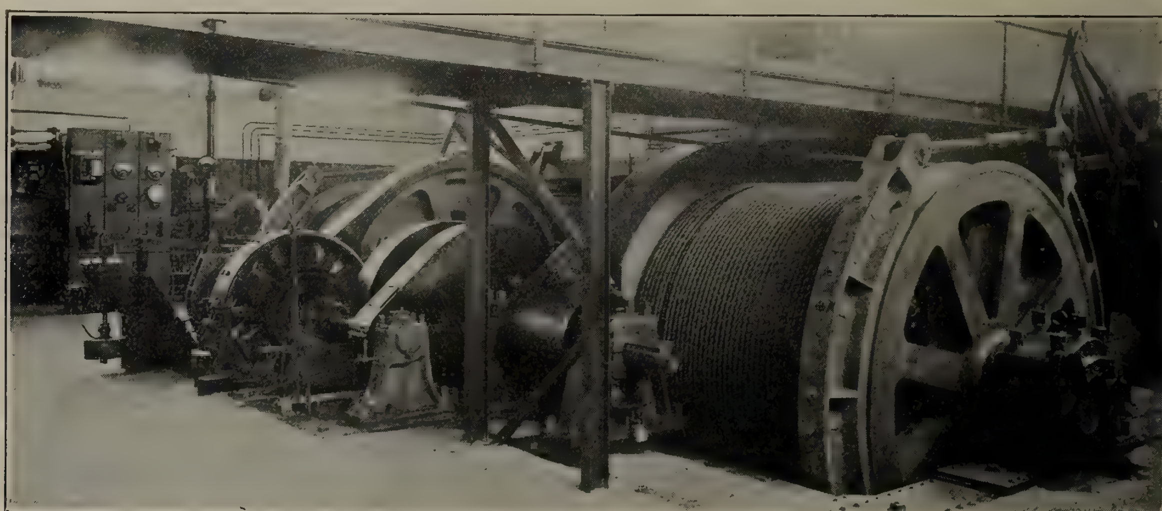
Shafts and drums.—The drum shaft is steel forging made in two pieces, 12 in. diameter. Including the two sections it is 32 ft. long and weighs 13,300 lbs. The intermediate shaft has been machined from a single steel forging and is 7 in. diameter its entire length. It is 20 ft. long and weighs about 3,000 lb. There are two cast iron drums 96 in. diameter, 70 in. face and coil 800 ft. of $1\frac{5}{8}$ in. rope, plus three holding coils at each end on one layer.

The intermediate gears are of cast steel with herringbone teeth, cut. The intermediate pinions are of forged steel.

Electrical equipment.—Power is supplied in the form of 3 phase, 25 cycle, alternating current, and for transforming this to direct current a Canadian General Electric motor generator set has been installed of sufficient

capacity to supply the average demand of the hoist, plus some surplus for charging the battery described below. The direct current end of this machine is rated at 165 amperes continuously at 550 volts, the latter being the floating voltage of the battery. This generator is driven by a 2200 volt induction motor. The generator end is designed with a special drooping characteristic by means of a reversed series field for the purpose of throwing load fluctuations on the battery. A small percentage of the load fluctuations falling on the machine will lower its voltage to such an extent that the battery must discharge and furnish the balance of the momentary demand. The regulation is, therefore, inherent in the design of the machine, and is entirely automatic.

The hoist is driven through two gear reductions, the total ratio of which is 29.84 to 1 by a General Electric 180 h.p. 500 volt 475-585 r.p.m. direct current motor which is especially designed to stand such voltage variations as come from a storage battery when it is frequently charging and discharging. The motor is controlled by a General Electric magnetic contactor panel so that it is convenient to control the motor remotely from the operator's station. This system of control admits of the various protective devices already described to ensure against the cage operating at greater than a pre-determined speed. To ensure a greater degree of continuity of service a reserve General Electric 180 h.p. motor and solenoid brake are provided. The machinery of the hoist is so constructed that in a very few moments' time one motor can be disconnected from the hoist and the other clutched in ready for service. The master controller is situated in the operator's cabin at the top of the incline.



Hamilton Mountain Park electric hoist, showing interpole motor, solenoid brake and over-winding protective device on drum shaft.

Storage battery.—The power plant has been supplemented by a storage battery built by the Electric Storage Battery Co., of Philadelphia. One of the objects of installing this was to reduce the maximum peaks due to the fluctuating load of the hoist, and thus reduce the power bills. Another object was to furnish current for operating the hoist if alternating current supply is interrupted.

The demand of the hoist motor when lifting a load of 7½ tons was estimated at 470 amperes for ten seconds, followed by a demand varying from 410 down to 230 amperes for a period of 80 seconds, the voltage being approximately 550 volts. Under the conditions of maximum schedule it was estimated that the load period of 90 seconds, mentioned above, would be followed by a three minute rest, thus providing for a trip of the hoist every four and a half minutes. For handling a 10-ton load, the maximum ten second demand was estimated at 530 amperes followed by 80 seconds of load varying from 470 down to 310 amperes. The hoist is designed to handle a 15-ton load occasionally, but this will not occur when the battery is handling the entire load with the power supply cut off. It is believed that hoisting a 7½ ton load every four and a half minutes will represent the average conditions during the hours of maximum traffic. The average load is 112 amperes on this basis.

The battery consists of 262 cells of the Tudor Box type. Each cell contains 11 plates, type F, measuring approximately 11x10½ in., five of the plates being positive of the Tudor type and six of the plates being negative of the Box type. The plates are supported in glass jars mounted on glass sand trays, the entire battery being installed on wooden racks. The capacity of this battery is 200 amperes for one hour on continuous discharge. For intermittent service extending over several hours the ampere hour capacity will be somewhat greater and it is estimated that this battery will operate the hoist under the average load conditions cited above over one and three-quarter hours with the power supply entirely cut off; or if the schedule is reduced, so that the trips of the hoist are made less frequently, the hoist can probably be kept in operation for several hours.

Under normal conditions with the motor generator supplying the average load, the battery does not become exhausted, but receives back sufficient charge during the period of rest between trips to make up for the discharge while the hoist is in operation. The battery, therefore, while relieving the motor generator and power line of the severe load fluctuations is maintained at all times practically full and ready to supply the entire demand in case of interruption to the power supply.

The Dorr Cyanide Machinery Co. announce that after May 1st, 1915, their New York office will be located at 17 Battery Place.

PERSONAL AND GENERAL

Mr. Jack Hammell is at Porcupine.

Mr. Alex Gray visited Porcupine this month.

Mr. Colin Campbell, of Campbell & Deyell, Cobalt, has joined the aviation corps.

Dr. A. Ledoux, professor of mineralogy at Brussels University is in Toronto, having joined the staff of the University of Toronto.

Over 300 members of the Institution of Mining and Metellurgy have enlisted, many are commissioned officers. Among those killed in action are William Hopkinson, Maurice Percival and Ernest John Murray.

Mr. G. Schack-Sommer, M.I.M.M. serving with the Russian army, has been awarded the St. George's Cross for valor.

Mr. James Ashworth addressed an audience in Vancouver, B. C., on April 14 on the subject of Mine Explosions. Various preventive methods were explained, and latern slides were used to illustrate the subject dealt with.

Mr. Wm. Blakemore headed a committee of the Victoria, British Columbia, Board of Trade which waited on Mr. David Carnegie, Prof. Alfred Stansfield of McGill University, and Dr. Alfred W. G. Wilson of the Mines Branch of the Canada Department of Mines, on the occasion of those three gentlemen visiting Victoria on April 12 in connection with their investigations relative to the facilities on the Pacific coast of Canada for the manufacture of shells, and the conditions bearing on the practicability or otherwise of establishing copper and zinc refineries in British Columbia.

Mr. R. W. Brock, dean of the College of Applied Science, University of British Columbia has attached himself to a local regiment so that military duty now occupies much of his time.

Mr. G. J. A. Buisson, formerly on the mining engineering staff at the Consolidated Mining and Smelting Co's Centre Star group of mines at Rossland, B.C., is now with the Mines Branch, Canada Department of Mines, Ottawa.

Mr. John Brown, late general manager for the Hillcrest Collieries, Ltd., Southwest Alberta, was a short time ago presented with a valedictory address and a valuable gift on his leaving the Blairmore-Frank district for the United States. Those who paid him this kindly compliment were members of the Western Coal Operators' Association and other friends in the district with the coal mining industry of which he had long been actively connected.

Mr. John D. Galloway, of Victoria, assistant mineralogist for the Province of British Columbia, has prepared his first official bulletin in that capacity and it has been printed as Bulletin No. 4, 1915, of the British Columbia Bureau of Mines. Its title is "The Mineral Resources of a Portion of the Omineca Mining Division." It is obtainable, gratis, on application to the B. C. Dept. of Mines.

Prof. Arthur Lakes has contributed to the Daily News, Nelson, B. C., some interesting notes on the subject of "Cottage Gardens in High Mining Camps." After giving some useful and interesting information, he concluded his notes with these words. "This subject may seem trivial except to those who have experienced the isolation common to many mining camps where nothing is trivial that contributes ever so little to comfort and interest. We hope that members will try the experiment and that some of our mining camps may become as attractive as many country spots and villages."

Sir Richard McBride, premier and minister of mines for British Columbia, who was in Ottawa early last month, afterward proceeded to New York, and thence to London on official business.

Mr. Thos. McGuckie, formerly of Nanaimo Vancouver Island, B. C., where he was for some time general superintendent for the Western Fuel Co., was one of those injured at the Britannia mine when about six weeks ago, a disastrous slide occurred there. Fortunately he was not very seriously hurt.

Mr. W. G. Norrie, late of Vancouver, B. C. for a number of years engaged in mining engineering in Alberta and British Columbia, is now with the Consolidated Mining and Smelting Co. at Trail, B. C.

Mr. Geo. W. Otterson, of Seattle, Washington, manager for the Kildare Mines, Ltd., an Eastern Canadian organization operating in the Omineca placer gold field in British Columbia, is preparing for the ensuing season's work.

Mr. Grant B. Schley, Jun., of New York, son of the head of the Howe Sound Copper Co., of that city, which controls the Britannia Mining and Smelting Co., will again spend some time at the company's property in Vancouver mining division, British Columbia. He was expected to arrive from the East in April.

Dr. W. G. Miller, A. G. Burrows and T. F. Sutherland were at Porcupine last week.

Mr. H. Foster Bain, formerly Editor of Mining Press and now Editor of the Mining Magazine sailed from New York, April 17 for London.

OBITUARY.

Clarence Edgar Copeland, mining engineer, and his wife were among the 53 who were killed in the snow and rock-slide that overwhelmed the upper camp of the Britannia mines, in British Columbia, in the early hours of March 22. Mining Press states that Clarence Copeland graduated with honors from the Colorado School of Mines in 1913 and since then had been engaged in professional work on the Pacific coast. He was only 25 years old, and had begun a most promising career. On January 6, 1915, he married Katherine Nora Holland, of Seattle, Washington, who died with him. He is survived by his father and mother, Mr. and Mrs. J. S. Copeland, of Los Angeles, California.

The Germans are still distributing documents to prove that Belgium was in conspiracy with England to bust the German Kultur.

In this particular the Germans are in the position of an intending burglar, who feels that a householder seen speaking to a policeman ought to be run in.—Life.

The Slocan Record, published at New Denver, on the eastern shore of Slocan lake, British Columbia, recently published the following among its news items: It is not improbable that before another year the greater portion of the Slocan ores will be treated at Kingston, Ontario. The Kingston smeltery offers a net return of about $6 a ton more than the Trail people.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND SOUTH LORRAIN

Once more the steam plants are shut down and the mines have all the electric power and compressed air they require without any recourse to their own plants.

This should reduce the large number of idle men who have been hanging around the camp all winter. The chief advantage will be in the mills which have been obliged to shut down in rotation for a quarter of the time since early in the year. It is most probable also that the favorable stock conditions will lead those companies who have been hesitating to resume to take the advantage of ample power to recommence operations. There will not be the excuse of lack of power to prevent them doing so, since the power company has notified all those who have made previous application of their intention and ability to give them all the air they want. Among those likely to resume are the Colombus, the Shamrock, the old Salvador and several other properties in southeast Coleman township.

Right of Way has already recommenced operations at the old shaft between the Cobalt Townsite and the Cobalt Aladdin or, as it is better known, the Silver Queen. For some time the drills will be used to break down the low grade ore that is known to exist in the old workings. A contract to mill thirty tons a day has been made with the Northern Customs concentrator. Later some further exploration work will be done in the endeavor to pick up new orebodies.

Elk Lake.—A small quantity of ore has been shipped from the Mapes Johnston mine at Elk Lake to Cobalt for the purpose of concentration and reshipment. The two and a half tons shipped was high grade and will run about 1,500 oz. to the ton.

Temiskaming.—The development at the Temiskaming mine still continues to disclose remarkable ore. The orebody has now been definitely located on three levels of the Temiskaming from the Beaver workings and three from the Temiskaming crosscuts. In the faces of two of these drifts the ore is remarkable, in the third it is good milling rock at the present. At the 400 ft. level, where the ore when first crosscut was only low grade, some of the most remarkable ore ever mined in the camp has been found. The vein at one place was from 8 to 9 in. wide of ore that has never been surpassed for richness. But the Temiskaming ore always runs in lenses, and any attempt to estimate ore reserves on present faces is fraught with great danger.

In addition to the new vein system, the end of an old ore-shoot has been uncovered on the 450 ft. level. The drift wherein the ore was found had been abandoned some time ago. It was cleaned out some few days ago and a very little exploration discovered five inches of remarkable ore in the end of the old vein that was being followed. As there is about a hundred feet of ground that has not been crosscut, it is reasonable to suppose that this working may yield a quantity of high grade ore.

The mill is running to capacity on development ore alone after all the high grade has been hand picked and passed over the bumping table.

Paragon.—One of the few properties working in the Elk Lake district is the Paragon Cobalt in Barber township. A small gang of men is putting down a shaft on an encouraging showing.

Shipments.—There has been a general resumption of bullion shipment during the past two weeks. Two-thirds of the ore is going to New York, where it is being sold to bullion brokers. This is the case with all the Nipissing bullion. Bullion shipped from the other mines and concentrators is crossing the ocean again in spite of the fact that the high insurance rate of ten dollars a thousand dollars is being maintained.

Chambers-Ferland.—Action has been entered restraining the Chambers-Ferland Company from transferring assets to the Aladdin Cobalt, Ltd. This action was taken in the interests of minority shareholders who did not desire to have their stock transferred at the ratio of 20 dollar shares of Chambers-Ferland for one pound share of Aladdin Cobalt, Ltd. Since the action was entered there has been heavy buying of the stock for the Aladdin Cobalt, and it is not thought likely that any immediate attempt will be made to force through the wishes of the majority shareholders.

Nipissing.—Production from Nipissing during the month of March, despite the fact that the low grade mill was only running three weeks of the month, amounted to $169,079, or more than enough to meet all dividend requirements. In development work several stringers have been found of the big vein 64. These stringers are all narrow and low grade, but are sufficiently encouraging to develop. It is interesting to notice that from shaft 150 it is believed that the extension of the Seneca vein has been picked up. Where it has been cut this vein is of calcite and low in silver. A raise is being started on it.

Pumping out of Kerr Lake has begun again. The water has all been drained off and the scow upon which the pumps are mounted has been moved about 60 ft. The pumps are already at work sucking out the mud from the bottom. Everything is ready to commence operations at Cobalt Lake, and the work of dewatering the lake will not now be long delayed.

Temiskaming and Hudson Bay Co. has an option on the Wright claims in southeast Coleman, and it is expected that work here will commence soon as air is now available for all requirements.

Dome—The March production at the Dome will be about $95,000 and the grade will run about $4.14.

A radical change is to be made in the method of breaking and hauling ore underground. At the 425 ft. level of the No. 2 shaft the biggest crusher ever installed underground for this class of work has been ordered. It will crush to five inch. The crushed ore will then pass over a grizzly and the over size will be treated in a secondary crushing plant before going to the stamps. The ore will then be shot into a 500 ton ore pocket. The ore will be collected from the various stopes by electric storage battery locomotives hauling trains of cars carrying five tons.

A great increase in efficiency in underground transportation has been made by the substitution of one large car for several small ones. The ore chutes have also been widened so that the big slabs of ore will not stick and necessitate breaking in the chutes. The crushing underground will still further facilitate the handling of the ore from the chutes. Costs, by these changes in transportation alone, have been reduced ten cents a ton.

There is not likely to be any addition to the actual milling plant of the Dome for some time to come; but greater efficiency is causing the material increase in tonnage from month to month. Like all other properties in the camp the Dome had to start up its steam plant while the power was short; but it has now been closed down again.

Miller-Middleton—Within a few weeks the Miller-Middleton claims will be linked up with the general system of the Hollinger and operations upon these properties of the Canadian Mining & Finance Co. will commence. So far, beyond some surface stripping and the sinking of a shaft to the 200-ft. level, little development has taken place here. A crosscut from the nearest drift of the Hollinger has been run at the 425 ft. level and is now within 200 ft. of its objective. A raise will then be put through to connect with the old shaft.

Vipond—Diamond drilling has commenced on the Porcupine Vipond at the 300 ft. level. Flat holes will be put on both from the west and east faces of the drift on the Davidson vein to discover the trend of the vein and obtain other data. The vein is taking a turn and it is believed that its future course can be more easily ascertained with the diamond drill than with a continuance of the drift.

The Vipond mill is now running very satisfactorily. For the first three months of the year the clean up amounted to $77,000 and the costs to $5 a ton. The heads were well up to the average for the Pearl Lake section of the camp, so that a good profit is being obtained.

North Thompson—Work is to be resumed on the North Thompson claims by the Huronian Belt Co. A working shaft of three compartments is to be sunk to the 300 ft. level and a contract has been let for the work, which will commence very shortly. For some months now the Porcupine Vipond has been using the steam plant of the North Thompson.

Porcupine Imperial has bought some machinery and will open up their old workings in Deloro in a month or two.

McIntyre—Diamond drilling on the No. 5 vein system of the McIntyre is still meeting with the most gratifying success. More recent operations cut the contact vein at the 500 ft. level, where it shows a width of seven ft. of twelve dollar ore. Profiting by the data obtained from the drill hole, a flat hole was started with the object of picking up the same vein on the 400 ft. level and it has now been located.

It shows in the core as 7 ft. wide and of a good grade of ore. The diamond drill has now been moved to the 300 ft. level where the location of the vein at that level will be attempted. The tonnage treated and consequently the production for the month of April is not likely to increase, as the ore in some of the stopes is wet from surface water and crushing is more difficult.

Porcupine Crown—A remarkable extraction is being obtained by the decantation process at the Porcupine Crown mill. Only 27 cents is in the tails and the extraction is 98.6 per cent. It has now been resolved to retreat the old tails that were banked from the old amalgamation plant. The capacity of the cyanide plant is larger than that of the crushing end and the treatment can be made without any interference with the ordinary course of development of the mine.

BRITISH COLUMBIA

Cariboo in the Sixties.—Occasionally reminder is given that it is more than half a century since metalliferous mining was commenced in British Columbia by the reprinting in the Victoria Daily Colonist of news items taken from its issue of fifty years ago. One that appeared on April 16 follows: "Assay office in Cariboo. Mr. Edwin Russell, of the Bank of British Columbia, left yesterday for the mainland and he will assume the managership of the bank at Richfield. He is taking with him an experienced assayer who will spend considerable time in examining the mineral wealth of that district." Richfield was on Williams creek, about a mile or so from the town of Barkerville Bancroft said, in his "History of British Columbia:" "Toward the close of the season of 1861, all previous discoveries were exceeded by the developments in the rich ground lying 50 or 60 ft. under the flat below 'the canyon.' To the Barker Company belongs the credit of having sunk the first paying shaft into the new deposit, and in honor of this event the nucleus of a town creek, about a mile or so from the town of Barkerville. Supported by the underground mining, the town grew rapidly in population and maintained for years the position of the principal town in Cariboo. (It was destroyed by fire in the summer of 1868, but by the end of September forty new buildings had risen.' The Diller Company were among the next in order to bottom a shaft into deep ground, washing out in one day, it is said 200 lb. of gold (Worth, at $16 an oz., $34,400.) Large as was the yield of 1862, the following season proved even more prosperous, and received the appellation of 'the golden year.' According to Macfie, the creek was then worked over an area of seven miles, and of the numerous claims about 40 yielded handsomely, while about 20 produced steadily between 70 and 400 oz. a day. Palmer states that the chief owner of the Cameron claim went home with $150,000 saved by him in one year."

The foregoing digression is ended with the mention of Cameron for the reason that it is quite likely there are to-day living in Ontario readers of the Canadian Mining Journal who remember the home-coming of Cameron (was it not to Cornwall or its neighborhood.) Again, in 1885-1886 Mr. J. McEvoy assisted Mr. Amos Bowmen in his geological investigations and other preparations for an official report and maps of the world-famed Cariboo gold-diggings. It is of interest to note that gold-milling was commenced in a small way at Richfield in 1876, and that was probably the earliest milling of metalliferous ore done in British Columbia. Coming down to the present, Mr. John Hopp continues to work on a fairly large scale placer-gold properties on or near Williams creek, and it is also noteworthy that during the last two field-work seasons the work of testing the flats adjacent to the lower portions of Williams creek has been in progress, boreholes having been sunk by means of a Keystone drill, and that the test work is to be continued this season, the object being to determine whether or not the gravels contain gold in sufficient quantity to warrant gold-dredging on an important scale being undertaken here.

A rough estimate of the value of the gold taken from the Cariboo district in all years to the end of 1914 places the total at approximately $42,000,000. How much gold is still contained in the enormous quantities of gravels known to occur in the district, and largely unworked, can only be guessed. With railway transportation now being provided, and if capital be made available for systematic operations with modern gold-

saving appliances, there is little doubt that the Cariboo district will be productive for many years to come.

East Kootenay.

Ore Production Larger.—A comparison of the output of the metalliferous mines of Fort Steele mining division of East Kootenay district shows a considerable increase for the first quarter of 1915 as compared with the corresponding period of 1914. During thirteen weeks of the current year, ended April 1, the total quantity of ore received at the Consolidated Co's smelting works at Trail from East Kootenay was 10,502 tons, all of which was from the company's Sullivan Group mines. This compares with 4,609 tons in the first quarter of 1914, including 246 tons from the company's St. Eugene mine, the remainder having been Sullivan ore.

Coal Mining Outlook.—District newspapers state that the outlook for an enlarged demand for coal is promising. It has been announced that instead of obtaining coal for its Manitoba division lines from the United States, the Canadian Pacific railway will use coal from southern Alberta and the Crowsnest district of Southeast Kootenay, British Columbia. A published report places the amount of coal, additional to past requirements, that the C. P. R. will need for its Manitoba system west of Winnipeg at about 2,000 tons a day. While this report has not been officially confirmed, it is of interest to know that in the districts directly interested confidence prevails that the demand for coal will be larger and that consequently coal-miners will not lose so much time this year, by reason of lack of orders for coal, as they were unfortunately compelled to do last year.

West Kootenay.

Slocan.—A report has been published in Spokane, Washington, in effect that the superintendent of the Rambler-Cariboo mine, in McGuigan basin, had advised the directors of the Rambler-Cariboo Mines, Ltd., in which city is situated the head office of the company, that a shoot of high-grade silver-lead ore the existence of which was not previously known, had recently been found on the 900-ft. level of the mine. Generally favorable accounts of progress at the Rambler-Cariboo mine and concentrator have been received, a considerable improvement having been effected all round since the appointment of Mr. W. A. Cameron as superintendent. During 14 weeks of the current year, ended April 8, the total quantity of crude ore and concentrate received at Trail from this mine was 605 tons. Figures given by the Daily News, Nelson, show that in January and February 172 tons of zinc concentrate was shipped from the Rambler-Cariboo mill to the United States. The Slocan Record, New Denver, states that Mr. Cunning, of Sandon, intends to resume development of the Mercury claim; also that work has been discontinued at the Payne mine, near Sandon, following the occurrence of a fire at the office, in Spokane, of those who have been developing the property at depth, under an option to purchase. Ore running 300 oz. of silver to the ton is being stoped in the Molly Hughes mine, near New Denver; the shoot of good ore is about 10 in. wide. Bids are being invited for doing 150 ft. of underground work on the Hartney, on Silver mountain, near New Denver. Ore is reported to have been encountered in the lower adit of the Echo, situated above the Standard mine, in Silverton camp.

Nelson.—Attention having lately been drawn to the occurrence of molybdenite near Salmo, which is in this mining division, the following excerpt from an official bulletin, issued early in the current year by the British Columbia Department of Mines, may be of interest: "The mineral molybdenite has been discovered in what appears to be commercial quantity, at the head of Lost creek, some 15 miles from the town of Salmo, and two carloads of the mineral has been mined and taken to Salmo for shipment. The deposit would appear to be of considerable size, but, judging from the samples sent to this Department by the owners, the material will require to be concentrated to bring it up to the market requirements of about 85 per cent. molybdenite." It is known that one lot of 15 tons shipped to the United States for test treatment yielded about 11 per cent. molybdenite. This was probably selected ore. As yet, however, no considerable development of the deposit has taken place, so it is, perhaps, too soon to judge of its commercial importance. As the mineral is found in a number of places on the group of claims, though not in all of them in such quantity as where shipment was made from, it is evident that much more exploration and development must be done before an adequate idea of the commercial value of the deposit can be obtained.

Boundary.

Phoenix—Diamond drilling was resumed on the Granby's property here on April 3 by Mr. Page Boyles, the diamond-drill contractor, who on that date reached Phoenix from Spokane.

Samples of good ore have been received in Grand Forks from the Gloster claim, in Franklin camp, North Fork of Kettle river. The ore contains copper and silver. The orebody was reached by a 90-ft. adit which intersects a vein four ft. in width.

A report is current and given credence that a shoot of ore of good grade, encountered some time ago when diamond-drilling in the British Columbia Copper Co's Mother Lode mine near Greenwood, is to be mined and that the ore will probably be smelted at the Granby Co's smeltery at Grand Forks. Confidence is felt at Greenwood that operation will be resumed at that mine shortly.

Gold Receipts.—Published figures, showing gold receipts at the Dominion of Canada Assay Office at Vancouver, British Columbia, during the fiscal year ended March 31, indicate that there was a considerable increase as compared with those for the corresponding period ended March 31, 1914. The number of deposits was 1,283 against 808 for the preceding year, which gives an increase in number of 475 deposits. The weight of the gold received was 169,834.26 troy oz. against 118,286.48 for the year before, an increase of 51,547.78 troy oz. The net value of the gold received was $2,105,136.12, as compared with $1,456,468.70, an increase in value of $048,667.42. While particulars of the sources of the gold received last year have not been obtained, it is known that about one-half of the total was from British Columbia mines, and the greater part of the other half from Yukon Territory. Receipts for the calendar year 1914 were not so large as those for the last fiscal year, as stated above. The figures for the calendar year were: Number of deposits, 1,115; weight of gold in Troy ozs., 166,150 oz; net value, $2,029,500. These figures show increases over those for the calendar year 1913, as follows: In number of deposits, 332; in weight of gold, 54,650 troy ozs; in net value, $580,785.

Dividends.—During the first quarter of the current year three metalliferous mining companies operating in British Columbia have declared dividends, namely the Consolidated Mining and Smelting Co., the Hedley Gold Mining Co., and the Le Roi No. 2 Ltd. That of the Consolidated Co. was Dividend No. 16, at the rate of two per cent. for the quarter or eight per cent. per annum on its issued capital; total amount of the

dividend, \$116,098; payable on April 1. That of the Hedley Co. was of three per cent. on its issued capital of \$1,200,000; and a bonus of two per cent., together five per cent. total amount of dividend \$60,000; payable March 31. That of the Le Roi No. 2, Ltd., was of one shilling a share on its 120,000 shares; total amount of dividend £6,000; payable May 1. Le Roi No. 2 directors receive an allowance of 5 per cent. on amount of dividends paid, so that £300 has to be added, which brings the total of this dividend disbursement up to £6,300, or approximately \$30,681.

SETTLEMENTS FOR SILVER AND LEAD IN BRITISH COLUMBIA.

The Kootenaian, Kaslo British Columbia, has published information relative to "improved terms of settlement" for silver and lead contained in ores, as offered by the Consolidated Mining and Smelting Co. on ores shipped to its smeltery at Trail. The Kootenaian says, in part: It is stated that the metal markets having become more nearly normal, although still affected somewhat by war conditions, and that the Consolidated Co., owing to the manufacture in Canada of shrapnel shells for the British Government has been able to market its lead, the company is once more in a position to receive silver-lead ores, and to settle for them in the ordinary way. The changed conditions necessitate some alterations in rates, which the smeltery officials claim do not affect shippers adversely, but provide what is likely to be a more permanent basis of settlement.

The new basis of settlement provides that payment for silver will be made at 95 per cent. of the fire assay at the New York quotation, as before. Payment for lead will be at 90 per cent. of the fire assay at the Montreal competitive price less one cent and a half a lb. Quotations used in settlement for both silver and lead will be the average of the second month following the date of receipt of the ore at the smeltery. Rates for treatment will be similar to those that prevailed prior to August 1, 1914. The customary advance to shippers will be made, shortly after sampling, of 90 per cent. of the estimated value on quotations current at the date of receipt of ore at the smeltery; the balance will be adjusted as soon as shall be practicable after the close of the second month following the date of receipt.

With respect to the Montreal price for lead—this is to be made up daily by Messrs. Thos. Robertson & Co., Ltd., of Montreal, by adding to prices current in St. Louis, London, or other competitive market, the freight, duty, wharfage, and insurance which an importer from such market would be obliged to pay, whichever provides the lowest price paid down in Montreal.

These new terms were to become effective upon ore received at Trail on April 1, 1915, and thereafter.

COPPER PRODUCTION ON BRITISH COLUMBIA COAST.

The recent visit to British Columbia of Mr. David Carnegie, Dr. A. W. G. Wilson, and Dr. A. Stansfield, and their enquiries relative to matters bearing on a suggested establishment of a copper refinery in that province, have directed attention to the production of copper in Western Canada. In this connection it is of interest to note that on March 1, in the course of an address to a meeting of the Western Branch of the Canadian Mining Institute held in Victoria on that date, Sir Richard McBride, premier and minister of mines for British Columbia, said:

"Now I come to deal more particularly with the Coast district mineral production, and here the most noteworthy feature is the large increase in copper production, as indicated in the following figures:

	lbs.
"During the last five years the total copper production on the lower Coast amounted to.	57,020,627
Ditto in Portland Canal Skeena, and Queen Charlotte mining divisions	11,240,104
Making a total of	68,260,731

from this section of the province, which only serves to emphasize what I said in my opening observations as to the future of this portion of British Columbia.

"Of the total production of copper in the Coastal districts during the last five years, 36 per cent. was produced in 1914, in which year the output was more than 50 per cent. larger than in any other year since a beginning was made to produce copper from mines in this district. It should be noted that nearly all of the 1914 production was made at two mines—the Britannia, near Vancouver, and the Hidden Creek, on Observatory inlet. Neither of these mines, however, was worked to capacity last year, war conditions having prevented, so that when normal conditions shall be restored it will not be unreasonable to expect an output from them of 40,000,000 to 45,000,000 lbs. of copper a year, without including the output of several much smaller mines that will probably also be producers in the near future."

Particulars of production in the Coastal district for the five-year period above referred to are given in the table that follows. It should be kept in mind that the figures for 1914 are estimated; also that the statistics of the British Columbia Department of Mines usually show a somewhat larger production than do those of the Dominion Department of Mines. The British Columbia figures for the Coast and Cassiar districts are as under:

	Lower Coast.	Portland Canal Skeena, Queen Charlotte, etc.	Total.
	lbs.	lbs.	lbs
For 1910.	3,078,090	. . . .	3,078,090
For 1911.	10,998,721	19,151	11,017,872
For 1912.	15,429,778	88,403	15,518,181
For 1913.	14,443,793	3,174	14,446,967
For 1914.	13,070,245	11,129,376	24,199,621
Totals.	57,020,627	11,240,104	68,260,731

Those interested in the copper production of British Columbia and to whom the Transactions of the Canadian Mining Institute are accessible may find in Vol. XVI, 1913, on pp. 576-583, particulars of the industry to the end of 1912. The total quantity of copper produced in the province in all years, as shown in the official records of the British Columbia Department of Mines, was 503,737,902 lbs. Of that total approximately 65,251,000 lbs. was from what is officially known as the Coast district, and 1,721,000 lbs. from mining divisions included, officially, in Cassiar district. If there be added to the total of the whole province the production of 1913 and 1914 say 91,460,000 lbs. a grand total for all years of, in round figures, 595,198,000 lbs. will be obtained. It is noteworthy that more than 50 per cent. of that total was the production of seven years, 1908-1914.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto.)

New York Curb Stocks.

	April 22, 1915. Bid	Ask
Alaska Gold	...	.40
British Copper	.00¾	.01
Braden Copper	.08⅜	.08½
California Oil	293.00	295.00
Chino Copper	.46⅞	.47¼
Giroux Copper	.00½	.01
Green Can	.34	.35
Granby	.89	.90
Miami Copper	.26¼	.26½
Nevada Copper	.15⅛	.15¼
Ohio Oil	130.00	140.00
Ray Cons. Copper	.24⅛	.24⅜
Standard Oil of New York	189.00	191.00
Standard Oil of New Jersey	390.00	392.00
Standard Oil (old)	1395.00	...
Standard Oil (subs)	895.00	...
Tonopah Mining	.07⅛	.07⅜
Tonopah Belmont	.04	.04¼
Tonopah Merger	.39	.41
Inspiration Copper	.32	.32¼
Goldfield Cons.	.01½	.01⅝
Yukon Gold	.02⅞	.03

Porcupine Stocks.

	Bid	Ask
Apex	.04⅛	.04¼
Dome Extension	.10¼	.10½
Dome Lake	.18	.20
Dome Mines	13.40	13.70
Foley O'Brien	.28	.34
Hollinger	23.50	24.00
Jupiter	.13¼	.13½
McIntyre	.50	.51
Pearl Lake	.01⅜	.02
Porcupine Gold	.00½	.00¾
Imperial	.05½	.05¾
Preston East Dome	.02¾	.03⅛
Rea	...	.12
West Dome (new stock)	.04⅞	.05⅛
Porcupine Crown	.81	.84
Porcupine Vipond	.58	.60

Cobalt Stocks.

	Bid	Ask
Bailey	.02⅞	.03
Beaver	.38	.40
Buffalo	.50	.70
Chambers Ferland	.22	.23
Coniagas	4.70	5.00
Crown Reserve	.88	.96
Foster	.03	.04
Gifford	.02¼	.02⅝
Gould	.00¼	.00¾
Great Northern	.03	.03½
Hargraves	.01¼	.01½
Hudson Bay	.17	.19
Kerr Lake	4.85	5.00
La Rose	.50	.58
McKinley	.30	.35
Nipissing	6.05	6.10
Peterson Lake	.22	.24
Right of Way	.05¼	.05½
Leaf	...	.02½
Silver Queen	...	.02½
Temiskaming	.42½	.43
Trethewey	.12½	.15½
Wettlaufer	.04	.05
Seneca Superior	1.30	1.35
Teck Hughes	.04	.05

TORONTO MARKETS.

April 23—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 13 cents per lb.
- Lead, 5½ cents per lb.
- Tin, 56 cents per lb.
- Antimony, 25 cents per lb.
- Copper casting, 18½ cents per lb.
- Electrolytic, 18½ cents per lb.
- Ingot brass, yellow, 10c.; red, 12 cents per lb.

April 23—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $8.00 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

April 21—Connellsville coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.55 to $1.65 per ton.
- Foundry coke, prompt, $2.00 to $2.50 per ton.

April 21—Tin, straits, 44.00 cents.
- Copper, Prime Lake, 17.75 to 18.00 cents.
- Electrolytic copper, 17.50 to 17.62½ cents.
- Copper wire, 18.75 cents.
- Lead, 4.20 cents.
- Spelter, 12 to 12.25 cents.
- Sheet zinc (f.o.b. smelter), 13.50 cents.
- Antimony, Cookson's, 32.00 to 33.00 cents.
- Aluminum, 18.75 cents.
- Nickel, 42.00 to 45.00 cents.
- Platinum, soft, $40.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $65.00 per 75-lb. flask.

SILVER PRICES.

April—	New York cents.	London pence.
7	50¼	23¾
8	50¼	23⅝
9	50⅛	23⅝
10	50⅛	23⅝
12	50⅛	23⅝
13	49⅞	23½
14	49⅞	23½
15	50	23 9/16
16	49⅞	23½
17	50	23 9/16
19	50⅜	23¾
20	50⅜	23¾
21	50½	23 13/16
22	50½	23 13/16

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Summary Report of the Geological Survey for the year 1913.

NEW BRUNSWICK and NOVA SCOTIA

Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

QUEBEC

Museum Bulletin No. 3. The Anticosti Island faunas, by W. H. Twenhofel.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.

ONTARIO

Museum Bulletin No. 5. A Beatricea-like Organism from the Middle Devonian, by Percy E. Raymond.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES

Memoir 47. Clay and Shale Deposits of the Western Provinces, Part 3, by Heinrich Ries.
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Museum Bulletin No. 4. The Crowsnest Volcanics, by J. D. MacKenzie.
Memoir 61. Moose Mountain District, Southern Alberta (Second Edition), by D. D. Cairnes.

BRITISH COLUMBIA

Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 51. Geology of the Nanaimo Map-Area, by C. H. Clapp.
Memoir 55. Geology of Field Map-Area, B. C., and Alberta, by John A. Allan.

YUKON AND NORTH-WEST TERRITORIES

Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA

Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N.S.

QUEBEC

Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO

Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

BRITISH COLUMBIA

Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 136A. Hazelton-Aldermere, Cassiar and Coast Districts, British Columbia.
1321. Diagram Showing the Geology of Texada Island, British Columbia.
Map 106A. Groundhog coal field, British Columbia. Geology.

YUKON AND NORTH-WEST TERRITORIES.

Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.
Map 58A. Explored Routes in the Lower Parts of the Drainage Area of Churchill and Nelson Rivers, Manitoba and Saskatchewan. Geology.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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Converters—
Fraser & Chalmers of Canada, Limited.
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Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.

Conveyor—Trough—Belt—
Hendrick Mfg. Co.

Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.

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Mussens, Ltd.

Cranes—Overhead Traveling—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

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Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
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Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
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Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.

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Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

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Diamond Drill Contracting Co.
Smith and Travers.

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Boving & Co. of Canada, Ltd.

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Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

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Northern Canada Supply Co.
Mussens, Ltd.

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Sullivan Machinery Co.
Mussens, Ltd.

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Can. Ingersoll-Rand Co., Ltd.

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Curtis & Harvey (Canada). Ltd.
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Northern Canada Supply Co.

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Northern Electric Co., Ltd.

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Mussens, Ltd.

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Can. Ingersoll-Rand Co., Ltd
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Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
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Mussens, Ltd.
Alex. Fleck.
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Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
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Northern Canada Supply Co.
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Boving & Co. of Canada, Ltd.

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Dodge Mfg. Co., Ltd.

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Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Peacock Bros.

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Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.

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Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

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Roberts & Schaefer Co.

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Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
International Nickel Co.

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Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
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Nickel—
International Nickel Co.

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Northern Canada Supply Co.

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Ledoux & Co.
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Milton Hersey Co., Ltd.
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Hendrick Mfg. Co.

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Sullivan Machinery Co.

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Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
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Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Mussens, Ltd.
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Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
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Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
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Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
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Pumps—Pneumatic—
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Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
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Quarrying Machinery—
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Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

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Rolls—Crushing—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville

Rope Blocks—
Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
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ALPHABETICAL INDEX TO ADVERTISERS

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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 10

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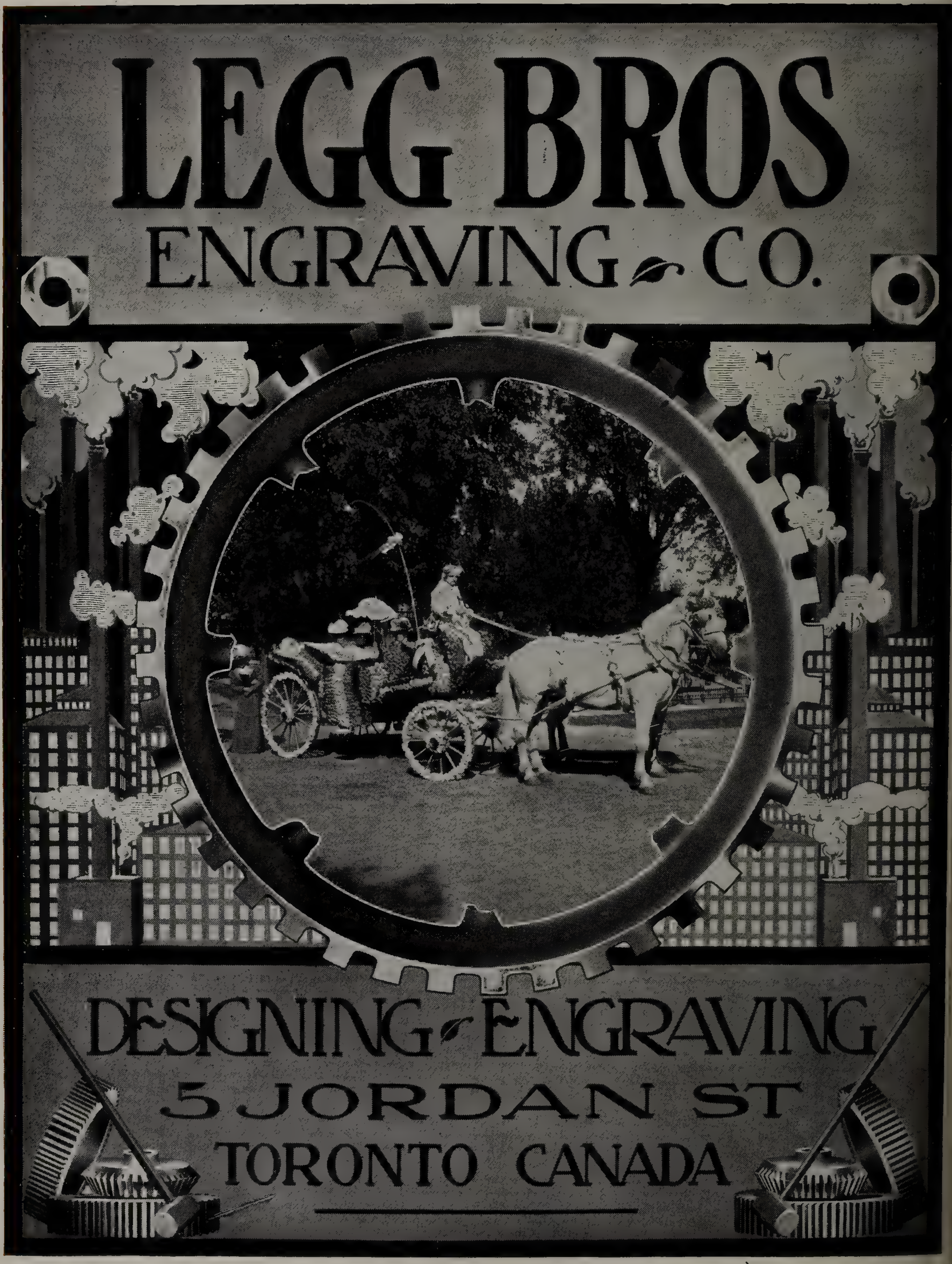
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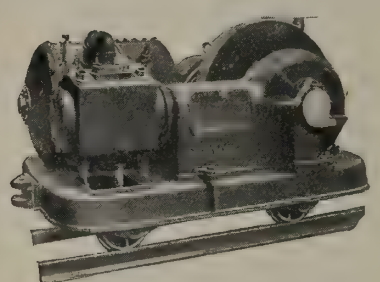

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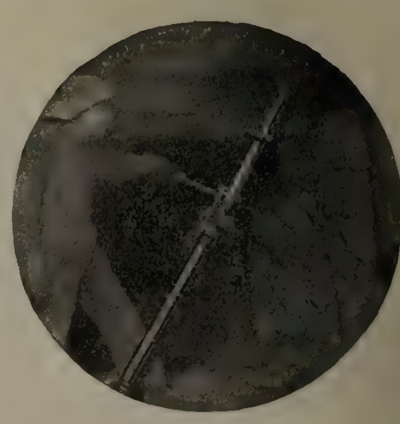

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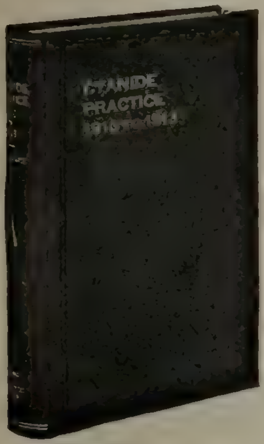

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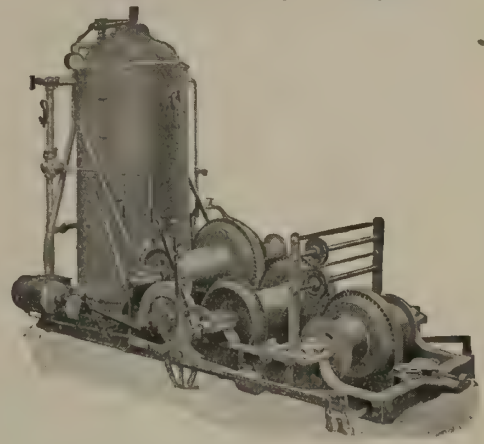

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, May 15, 1915. No. 10

The Canadian Mining Journal

With which is incorporated the

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REGINALD E. HORE

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CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

GERMAN WARFARE

For some time Germany has been regarded as an outlaw among the nations. It is becoming more and more evident that the term outlaw is scarcely applicable. The Kinsale jury has diagnosed the case.

The dastardly treatment of the Belgians, the raids on unfortified towns, the use of asphyxiating gases in direct violation of accepted rules of warfare, the murder of passengers on an unarmed ship; these are crimes that Germany cannot hope to live down in this generation, nor in the next. Germany has gone on record for all time as the nation of murderers.

In characteristic German, the murderers claim that they issued warnings of the premeditated crime, and that therefore the crime is excusable. And this is the nation from which we have been drawing teachers for our colleges!

We are not greatly surprised that the Germans tried to sink the Lusitania. We would not be surprised if they should attempt more such murders. That they succeeded in their attack was the only surprise. The British navy must have been very busily occupied elsewhere.

One result of the crime will be that citizens of the United States will recognize more clearly that the Germany of to-day is the foe of mankind. Americans were not slow to see the significance of the German crimes in Belgium. They will, by the loss of their fellow-countrymen on the Lusitania, appreciate that the Allies' cause is theirs also.

In Canadians the news of the sinking of the Lusitania and the loss of so many innocent lives has aroused a feeling of repulsion towards anything German. It is not mere hatred of an enemy; but a feeling of loathing, such as one has for a common murderer. Even of the Prussians we expected something more noble than this. That the soldiers despised even the civilians of their own country was commonly believed; but that they would murder unarmed Belgian citizens, butcher wounded soldiers and sink passenger ships without warning is a revelation. There is but one way to treat these criminals. An overwhelming force must be provided. Every citizen of the Empire must assist in the task of punishing the murderers of babes.

THE CANADIAN MINING INSTITUTE

In a letter to the secretary of the Canadian Mining Institute, Mr. B. Neilly, of Cobalt, refers to differences of opinion as to the character of the Institute. He asks whether it is a technical society or an association

to further the interests of the Canadian Mining Industry. The question is readily answered by the following extract from the Charter:

"Whereas the persons hereinafter named have, by their petition, represented that an association known as the Canadian Mining Institute has been founded by the said persons, and others, for the following purposes, namely:

"First, to promote the arts and sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications. Second, the establishment of a central reference library and a headquarters for the purpose of this organization. Third, to take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada. Fourth, to encourage and promote these industries by all lawful and honorable means. And whereas the said persons have prayed that it be enacted as hereinafter set forth, and it is expedient to grant the prayer of the said petition: Therefore Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

"1. John E. Hardman, George M. Dawson, William A. Carlyle, Charles Fergie, John Blue, B. T. A. Bell, A. W. Stevenson, James McArthur, Archibald Blue, William Hamilton Merritt, F. T. Snyder, Henry S. Poole, Wilbur L. Libbey, Robert G. Leckie, Clarence H. Dimock, Geo. E. Drummond, Geo. R. Smith, J. Obalski, John J. Penhale, R. G. McConnell, Frank C. Loring, John B. Hobson and William Blakemore, together with such persons as hereafter become members of the Institute are hereby incorporated under the name of 'The Canadian Mining Institute,' hereinafter called the 'Institute,' for the purposes set forth in the preamble."

The first two by-laws as to membership are:

"1. Members shall be persons actually engaged in the direction and operation of mining and metallurgical works, mining engineers, geologists, metallurgists, chemists and such other persons as the Council may decide are eligible through connection with mining affairs.

"2. Associate members shall be persons directly or indirectly associated with or interested in the business of mining, but not included under Sec. 1. Associate members shall be entitled to vote, but may not hold office."

The charter and by-laws make it clear that the Canadian Mining Institute was not intended to be, and it is not, merely a technical society. The Institute has a far larger purpose to serve.

ASPHYXIATING GASES IN WARFARE

It seems a waste of time to indulge in further recrimination of the Germans because of their inhuman mode of warfare. We are now resigned to the inevitable proverb: "What can one expect from a pig but a grunt?" But the latest barbarism, that of the use of asphyxiating gases, chlorine and bromide, is of particular interest to miners, because the Germans seem to have used oxygen breathing apparatus in their deadly work. Roland Hill's despatch to the Montreal Star, of the 26th April, says: "Front ranks opened up close to our (Canadian) trenches, and hand-grenade men, with special breathing apparatus, broke through with gas bombs."

The British Government despatched Dr. J. S. Haldane, whose name every miner knows from his exhaustive researches into mine gases and their effects on the human organism, and his experiments on oxygen breathing apparatus—to report on the nature and effects of the gases used by the Germans. Dr. Haldane states men who breathed these gases died of acute bronchitis caused by inhalation of an irritant gas, probably chlorine or bromide. Chlorine gas is heavy and would cling close to the ground. No man is better qualified to recommend counter-measures than Dr. Haldane, and we can rest assured that the resources of science are not all in the hands of our enemies.

It may not be generally known that oxygen breathing apparatus is part of the equipment of the German Zeppelins, and will enable the aviator to breathe with ease at heights which would render breathing impossible or very difficult to the unaided human organism. Every German submarine is equipped with breathing apparatus, which gives the occupants an additional lease of life in case the air inside the submarine for any reason becomes irrespirable. The same apparatus also enables men to escape from a submerged submarine, through the manhole provided for this purpose, and reach the surface of the water.

Oxygen breathing apparatus have been used by the French in gathering decomposed bodies on the battlefield.

It may be confidently expected that the British authorities will speedily evolve some form of respirator which will nullify the devilish devices of our unscrupulous foes. There are several large manufacturers in Great Britain capable of meeting this new requirement quickly.

One of the German newspapers falsely states the British have used asphyxiating gases, and suggests that German scientists with their greater chemical knowledge would probably produce a more effective weapon. It is apparently a favorite trick of the Germans to accuse their opponents falsely of the use of some unlawful device of destruction, so as to minimize their own venality when they themselves commence to use it. But it may be remarked that the production of deleterious

gases is a game that two can play, and if the Germans are prepared to unlock all the destructive forces of nature remorselessly, they may meet some unpleasant surprises in return.—F. W. G.

McIntyre Porcupine Mines, Limited, will have a new interest for mining men now that Col. A. M. Hay, Sir H. M. Pellatt, W. J. Sheppard, J. B. Tudhope and J. P. Bickell are on the board of directors. These men are all Canadians who have been successful in many business enterprises, and who have the confidence of the public. Col. Hay is especially well known to mining men, being one of the most highly respected members of the Canadian Mining Institute.

The copper market continues to furnish sensations. The demand seems to grow as the price advances. Ordinary brands are finding a ready market at 19 cents per pound, and special brands of Michigan copper are in demand at 23 cents.

Dr. Waldemar Lindgren states that 100,000,000 pounds of tin, equivalent to about $40,000,000, is needed annually in the United States and is imported. This splendid market for tin should be kept constantly in mind by prospectors. It is not at all unlikely that there are tin deposits in Canada.

After June 1 the office of the Canadian Mining Journal will be in the new Purman building, 263-265 Adelaide street west. Call and see us in our new home.

The Cobalt branch of the Canadian Mining Institute has arranged for an excursion to Porcupine May 17-20. A number of mines and mills will be visited, and a meeting to hear methods described will be held on Tuesday evening. A committee, composed of Porcupine mine managers, will have charge of the program.

POTASH DEPOSITS IN SPAIN.

Particular interest attaches to the proposed Spanish potash law, in view of the fact that the American Agricultural Chemical Company said in its recently published annual report:

"Within the past year an important discovery of potash salts has been made in Spain, and through the opportune presence of your chairman in that country at the time the Spanish Government's examination of these deposits had been completed, your company has acquired from the Spanish Government some large concessions in the territory examined.

"These properties are now being surveyed, under the direction of an eminent Spanish mining expert, preparatory to boring them for potash. These deposits appear to be in every way similar to those of Germany, and, so far as reported upon, they are richer in quality and lie at a considerably less depth than the German deposits.

"It appears, therefore, as if Germany's potash monopoly might be broken, and your company placed in a position to obtain its potash from Spain in the near future."

OFF KINSALE

By B. F. Griffin, in Boston News Bureau.

"Only the baby's cap floating showed where more than a score sank."—News item.

An admiral, bearded, ponderous, grim,
At his desk with charts bespread,
And some four thousand miles from him
A babe in a trundle bed,—

How could they meet and when and where
And their alien paths collide?
Go ask yon mist-loved headland there
Long brooding above the tide,

With candy-stick lighthouse capped red-white
And girt with the fishers' sail,
That the Dane kings saw and Armada fight,—
Ask the Old Head of Kinsale!

In sight of the rude, warm fisher cot
At foot of the watching cliff,
Only a little white cap afloat
O'er grave of a foundered skiff.

More souls—two thousand,—various wrapped
With flesh and with circumstance,
Were in yon steel-gilt-plush cage trapped,—
Two-thirds had never a chance!

But what of number or of weight
In souls or in gold or steel?
To the rocking babe 'twere equal fate
Had his cradle been the keel!

An admiral, bearded, ponderous, grim,
At his desk with charts bespread,
And some four hundred miles from him
A babe in an ocean bed!

CORRESPONDENCE

STIMULATION OF PROSPECTING.

To the Editor of the Canadian Mining Journal:

Sir,—As I have for nearly twenty years followed the occupation of prospecting, I am, of course, interested in any suggested attempts to stimulate prospecting.

By a prospector I mean a man whose occupation is searching for minerals, expecting, as a reward for his labor, to mine and dispose of minerals found, or to sell his rights to others. In either case, security of title, character and value of ore and nearness to a market are the most important points to be considered. It therefore follows that it is unprofitable to prospect too far from where transportation facilities are available or in course of being provided. While Canada is today fairly well supplied with railroads, the mineral bearing areas through which these railways run are also pretty well staked into mining claims, but not developed, nor even properly prospected.

Old camps, mills and other mining machinery, evidence of the operations of J. Rufus Wallingford and Blackie Daw, are to be found; but no work is being done. Dead and all but deserted mining camps, of which mementoes in the form of mining shares are to be found in nearly every home in the United States, Canada and Europe, are not good advertisements, nor inducements for further investments in any new mining ventures, be they ever so legitimate.

As a result, the prospector is obliged to go far afield where discoveries are of doubtful value.

As conditions are to-day the prospector is idle, for his occupation is no longer profitable. As a matter of fact, he is claim poor.

At the same time, we find that Ontario and other Canadian mining companies are investing their surplus capital in mining industries in the United States, Mexico and Central America. Surely they would rather invest and operate in their own country, were conditions as favorable at home as they are abroad.

Then what is the matter with the conditions at home?

First. Terms, as usually asked, by owner or owners of mining claims, are considered by mining companies, looking for investments, as prohibitive.

Second. Ownership and title, as applied to defunct mining companies' properties, are too obscure.

Third. Too far from railway or other transportation facilities to make operation profitable.

As a remedy I would suggest that a sufficient tax be imposed on all leased or patented mining claims, on which a required amount of work had not been performed during the year, so as to make it unprofitable to hold mining lands without attempting to do mining. And in default of work being done or tax paid, the ground should become open for prospecting and staking. Such a law would open large areas of mining lands near to transportation; would also stimulate mining and prospecting, and curtail, if not eliminate, the operations of the wild catter and his brood. Then by the time that the mineral resources that may be in the unexplored North of Canada were needed, the Geological Survey Department would have that country surveyed and maps would be available to guide the prospector and miner. This would help eliminate the gamble ever present in prospecting and mining.

I am fully aware that to suggest that owners of leased or patented claims be required to do work or pay a tax, is about equal to disturbing a hornets' nest. But the mining companies who make a profit of mining and are employers of large numbers of men, are paying taxes, and the prospectors, up to the time of securing a lease or patent, are required to do so much work yearly or lose their claims. Then why should those who hold mining land without doing any work not be required to pay for that privilege?

The prosperity of the mining industry, as well as the Canadian people, is not measured by the amount of mineral land disposed of to individuals or companies, but by the number of people who are employed by that industry and the amount of metal recovered.

If the present system is continued Canada will, in the course of a few years, be in the same position as the United States is to-day, having no new country to prospect and explore.

In the meantime isolated mines, scattered over the country, fighting for their lives against an ever increasing cost of operation, are continually asking the Government for aid in providing the necessary facilities of transportation. Gowganda is a typical example of such a case. Of the thousands of claims leased, only three properties are working. A few leased claims are still owned by the original locators, but the majority are in the hands of bankrupt stock companies and speculators, who have no notion of ever doing any active mining or allowing the development of their properties by others who may wish to do it, before first securing a substantial cash payment. And the attitude adopted by the officials of the Bureau of Mines towards those who have attempted to prospect and locate lapsed mining claims, is not calculated to stimulate prospecting on any of the several hundred claims posted in the Recorder's office as cancelled for the lack of performance of work.

Under those conditions new discoveries of mineral can hardly be expected to be made. As a result, the camp is slowly dying for the lack of opportunity to make good.

As those conditions are more or less general throughout Canada, is it then any wonder that the mining men from the Atlantic to the Pacific are asking: What is the matter with and what can be done to stimulate prospecting?

Suggestions have been made that prospecting parties be sent out by the Government and that we establish State batteries. These would, at best, give only local and temporary relief, as only in some respects are all mining camps alike. All camps are hampered in their progress by idle claims. Every camp needs cheap power, in order to carry on mining. As idle claims are, more or less, a result of lack of cheap power, Government aid by supplying cheap power would go a long way towards relieving the situation and would be self-supporting.

The Ontario Government possess the opportunity to demonstrate the practicability of my suggestion, without any financial risks being involved, by erecting at the Indian chutes on the Montreal river at Elk Lake, a Hydro-Electric power plant for the purpose of supplying electric power to Gowganda mines. If not found profitable to the Government the power could be used for the electrification of the T. and N. O. Ry.

Yours, etc.,

L. HEDLUND.

Gowganda, May 10th, 1915.

SHOULD ONTARIO HAVE GOVERNMENT BATTERIES?

Mr. T. A. Rickard writing editorially in the April 17 issue of Mining Press on the article by Mr. Geo. R. Rogers, "Should Ontario have Government Batteries," April *Canadian Mining Journal*, says:—

We have some personal knowledge of the Government-owned plants in Western Australia, and can say that on the whole they have been a decided success. They have been the means of stimulating mining and prospecting in many remote districts where no plant for recovering gold was available, and in localities where the freight to a custom-mill is prohibitive. Even when a group of small properties contains good ore, the collective owners cannot afford to erect a plant, and so in time are forced to close. Then the Government steps in and provides the means whereby the gold is extracted at reasonable cost. Discontent is not unusual among miners who have not received the yield they expected, but who ever heard of a prospector who did not over-estimate the value of his ore? In Western Australia there are 37 stamp-mills and cyanide-plants operated by the State. These cost £332,378, and have treated for small mine-owners a total of 960,989 tons of gold ore yielding £4,109,321 and 64,920 tons of tin ore producing £80,835. It is certain that without these Government mills most of this metal would never have been recovered. The effort has stimulated mining and prospecting. One objection to the system does exist: the miners often extract the richest ore in their claims and then abandon them, whereas if the men had their own plants they might develop their properties.

MINERAL DEPOSITS NORTH OF SAULT STE. MARIE, ONT.

By Charles H. O'Connor.

The Algoma Central Railway in its tortuous route from Sault Ste. Marie to the little town of Hearst, some three hundred miles north, on the Grand Trunk Pacific, passes through one of the most picturesque parts of Ontario. For the first two hundred miles the country is rugged and broken, with hills and valleys and innumerable lakes and streams. It is clothed with virgin forests of spruce, pine, balsam, birch, poplar and maple. The scenery along this section of the railway is entrancing. A distant view of the limpid waters of Lake Superior; the rugged scenery of the famous "Horse Shoe Bend"; the dizzy heights of the Montreal river bridge with the falls thundering two hundred feet below; the misty grandeur of the Agawa canyon; and the exquisite beauty of Bridal-veil Falls are silent witnesses of the lavishness with which nature has painted this wonderful country.

The forest abounds with game, moose, red deer, caribou, bear, partridge, ducks and geese. In the lakes and mountain streams there are brook trout, lake trout, black bass, maskinonge, pickerel and white fish in abundance. Small fruits such as strawberries, raspberries and blueberries are very plentiful. The Algoma Central Railway Company has erected a number of cottages at various points along the line for the accommodation of tourists and hunters. These cottages are rented by the week, or for the season at a nominal fee.

North of the Height of Land the country is considerably flatter, and there are fewer rock outcrops. Here the land is slightly rolling and somewhat similar to the prairies of Western Canada. The timber is mostly spruce, while the soil is clay loam covered in many places with a few inches of rich black earth.

Gold at Wawa Lake.—Back in the spring of 1897 gold was discovered at Wawa lake in the Michipicoten district. An extract from a report by the late Prof. A. B. Willmott, sums it up as follows:

"In pursuance of instructions from the Director of the Bureau of Mines, I left Toronto on September 10th, 1898, to make a geological examination of the Michipicoten mining division.

"For some time a little prospecting had been going on in the Michipicoten district, but no valuable discoveries had been made. During the early summer an Indian named Thaddy showed specimens of quartz carrying free gold at Missinabie. For a consideration he pointed out, to James Dickinson, of North Bay, the situation of the vein on Wawa Lake. Samples were obtained, and rich assays were the result. On the first report parties hurried into the district from Sault Ste. Marie and were successful in locating other veins carrying free gold. Their glowing reports were the foundation of most sensational articles in Canadian and American journals, many referring to the district as another Klondike. Men began to arrive from all quarters of the continent, and even women came into the district as prospectors.

"Many prospectors, utterly unfit for their duties, unused to bush life, unable to canoe, often not knowing quartz when they found it, were induced to go into the district by the glowing accounts. It is not surprising that many quickly left. Unfortunately they told their friends that there was no gold in the country, when they should have said that they failed to find nuggets which could be shoveled into bags without the prospectors being forced to get out of their canoes.

"The excitement, however, brought other classes of men, some of them old prospectors, and others with experience of bush life. Many of these made finds, and still more of them were convinced that the district was well worth prospecting."

In a later report Mr. Willmott says in part:

"The Mackey claim (which was originally the Dickinson claim), situated one and one half miles south of Wawa city in Wawa lake, was discovered by an Indian named Thaddy. A sample composed of small fragments taken at random from many points on the vein yielded in my laboratory $65.50 to the ton in gold. Eleven assays made for Mr. Mackey ran from $13 to $145 to the ton. The veins vary from one to four feet in width and have been stripped for six hundred feet."

Several years later the Bureau of Mines Report, 1906, summarized the district as follows:

"The Michipicoten region first attracted attention in 1897 as a gold mining district, hundreds of locations being taken up in the next two or three years to the north of Wawa lake. On many of these, gold specimens of a very promising kind were found, but none of the prospects discovered can be said to have developed into mines, except the Grace, which was worked for some time, apparently at a profit, by the Lake Superior Power Co."

Grace mine.—Thus the first real mining "boom" in Algoma district was created. Of the hundreds of claims staked the great majority were abandoned on account of the scarcity of fuel, lack of capital and adequate machinery to work them. The Grace mine was operated for several years by the Lake Superior Power Company, during which time the main shaft was sunk to a depth of some three hundred feet. A few gold bricks were sent to the banks at Sault Ste. Marie; but during a financial stringency in 1905 the mine was closed down. It changed hands several times until it finally became the property of the Le Page Mining Co. The vein at the three hundred foot level is four and one half ft. in width and shows free gold. The mill was run spasmodically by the Le Page Co., and "clean-ups" aggregating $30,000 were made. The property is now under option and no doubt active operations will recommence at a very early date. The Michipicoten district was discovered at a very unfortunate time. Money was scarce and it was almost impossible to interest capital in Ontario gold. The surface showings are good and the Grace mine has proven that the values hold with depth, so it is reasonable to suppose that the Michipicoten gold fields will yet come into their own.

Helen iron mine.—About the time of the Michipicoten gold boom, the late Ben Boyer, while prospecting in the district for gold, discovered the Helen iron deposit, and Mr. Alois Goetz, of Sault Ste. Marie, Michigan, staked the Josephine and other iron properties.

The Helen mine was purchased from Mr. Boyer by the late Mr. E. V. Clergue and later turned over to the

Lake Superior Corporation. This property is too well known to require a detailed description here; but it is interesting to note that up to date over 1,500,000 tons of hematite ore has been mined, the largest portion of which was shipped to Sault Ste. Marie, where it was converted into steel rails for the various great railway systems of Canada.

Josephine iron mine.—At the Josephine, which is about ten miles north of and on the same range as the Helen, some 500,000 tons of good hematite ore has been proven up. On both the Josephine and Helen there are immense deposits of siderite (carbonate of iron) which have not as yet been mined.

The Magpie iron mine is located about twenty miles north of the Helen. This property was acquired by the Lake Superior Corporation from Messrs. Blackendon, Burke and Gibson in the summer of 1910. In July of the following year a railway branch was completed connecting it with the Michipicoten Division of the Algoma Central Railway. The ore is a siderite and magnetite and it is necessary to roast it to eliminate the sulphur and carbonic acid contents before it is smelted. A roasting plant with a daily capacity of one thousand tons and costing in the neighborhood of one million dollars has been constructed for this purpose. The operation of this plant was looked upon by many as an experiment and was watched with keen interest by engineers throughout the country. It must be gratifying to the officials of the Lake Superior Corporation to know that it has proven an unqualified success, and that their expectations have been more than realized in regard to the low cost of production and the excellent quality of ore thus produced. Over twelve million tons of ore have been proven up. The mine is operated electrically from power developed at Steep Hill Falls on the Magpie river.

Iron Mountain, which is perhaps the most gigantic magnetic iron deposit yet discovered in Ontario, is situated at Mile 182 on the Algoma Central Railway and some four or five miles south of the main line of the Canadian Pacific Railway. It was located by Mr. Harry Dreaney, of Toronto. In describing its discovery Mr. Dreaney says:

"In the summer of 1910 my attention was drawn to this district by some samples of very rich gold ore brought to Toronto by Messrs. O'Connor and McFadden of the Soo. I interested some friends with myself in investigating the find and during the time of proving up the gold, I personally sent prospectors over the surrounding country. The iron was among samples of highly mineralized quartz which the men brought in for inspection. I made a trip for investigation and found that the iron outcrop appeared to be of some extent. Strange to say I could not keep my men on it, as after I had ordered them to leave all the quartz veins alone and follow up the iron, I found on my return that they had abandoned it and gone off again developing the quartz veins. The 'lure' of the gold was strong on them. They had to be impressed that the iron had more attraction for me than the gold. But after they became acquainted with its possibilities they were quite efficient in tracing out the deposit by the strike and the magnetic readings of the dip needle. Judge John McKay had prospectors in the field about this time and staked some claims on the west end of the range."

The deposit has been traced for a distance of ten miles, and it varies in width from forty to one hundred and forty feet. It has been purchased under contract from Mr. Dreaney by the International Steel Co., Ltd., who purpose installing a concentrating plant at a cost of approximately one million dollars. Power to operate the plant has been arranged for and will be transmitted to the property from a developed power within the district.

The ore consists of alternate bands of high and low grade iron intermixed more or less with silica. The average percentage of iron is low, being probably 35 and 40 per cent., but the ore is practically free from phosphorus, sulphur and titanium.

In discussing the low grade iron deposits of this district the late Mr. E. A. Sjostedt, who was consulting metallurgical engineer for the Lake Superior Corporation at that time, says:

"The great economy in using high grade and pure furnace material, even when high in cost per ton, instead of a medium grade ore obtainable at a low cost, is being more and more realized by progressive blast furnace managers. The saving consists not only in a much more than proportional yield of pig iron and a much more than corresponding low fuel consumption per ton of pig iron produced, (owing to the purity and porosity and the higher oxidation of the iron in the briquettes which make them easily reduced), but also in the production of a first-class iron, which causes no trouble during its different stages of conversion and produces a high grade steel at a minimum cost. This latter advantage is not yet sufficiently appreciated in this country, but has long been recognized in Sweden where quality steel has proven the saving of the iron and steel industries in spite of the high cost of blast furnace fuel. A great many plants for the concentration of low grade iron ores (especially silicious magnetite) have therefore lately been installed in Europe and among them concentrating and briquetting plants in Sydstvanger district in Northern Norway. The ore is very similar in structure and composition to the ore of this district, averaging about 37.5% iron and 44% silica and is low in phosphorus, sulphur and titanium. By means of the Grondal method it yields a concentrate which averages about 67% iron, .006% phosphorus and .008 sulphur. Owing to the excellent results that have been obtained in the furnaces in Germany and England when using these imported Swedish concentrates, English and German capital have been freely available in Sweden and Norway for the installation of concentrating and briquetting plants at the Swedish and Norwegian mines. However, there is no need of going to Europe for seeing such plants in operation, as several Grondal plants have now been erected in the United States among which I lately visited that of the Pennslyvania Steel Co. at Lebanon, Pa., where 600 tons of ore are concentrated and nodulized daily. The results from this class of furnace material have here been exceptionally encouraging: General Manager Lee telling me that this company has lately erected a 1,200 ton plant in Cuba and that he expects to double his own plant, and looks forward to the time when he would need to use nothing but concentrates, as his records show that with concentrates alone he has been able to double his furnace output and decrease his furnace consumption 50 per cent. as compared with the old records when using the roasted Cornwall ores. The ordinary fuel saving and increase in blast furnace output, even when using high grade natural ores, amounts to 20 per cent.

This is the class of ore on which the future steel industries of Canada and perhaps of America must de-

pend. Over 75 per cent. of the iron ore used in Ontario blast furnaces comes from the United States, but with the rapid development of our immense deposits the time will shortly come when our steel industries will not only be supplied with ore mined exclusively in Canada, but we will also have an abundant supply for export.

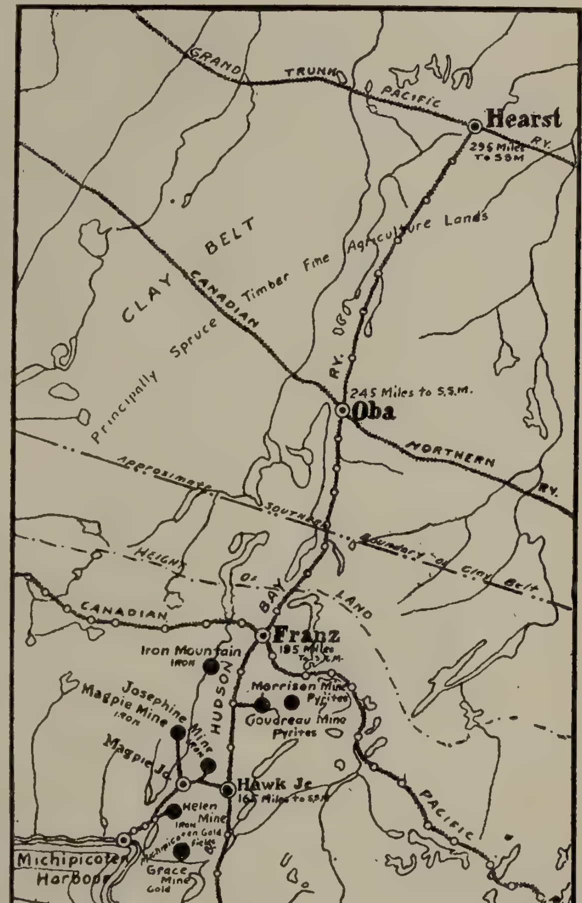
Goudreau pyrite mine.—At Goudreau lake, some two miles East of Goudreau station on the Algoma Central Railway, the Madoc Mining Company, a subsidiary company to the General Chemical Company of New York, N.Y., have for the past two years been engaged in diamond drilling an iron pyrites property which they have under lease from the Lake Superior Corporation. An immense body of ore has been proven up and with the completion of a railway spur which is now under construction to connect it with the Algoma Central active mining operations will commence. This ore is mined exclusively for its sulphur contents and is used extensively for the production of sulphuric acid. Some 50,000 tons of ore will be gotten out this summer from this property and shipped to the company's refinery for treatment. A large number of men will probably be employed.

Prospects—In addition to the above mentioned mines there are a number of prospects which are well worthy of mention. Among them being the Campbell-Murdock iron properties, five miles West of Wabos siding, where it has been estimated that there are upwards of eight million tons of magnetic iron ore; the Morrison and Wilcox properties which adjoin the Goudreau and on which there are large deposits of iron pyrites; and the Cameron and Byrne pyrites properties six miles East of Mile Sixty where an exposure of several thousand ft. of 40 per cent. ore has been uncovered.

The country, except in the vicinity of the railways and along the principal rivers and lakes, has only been roughly prospected. With a systematic examination there is every possibility that numerous other valuable mineral discoveries will be made.

Timber—Extensive lumbering operations have been going on in this district for several years and while large portions of this territory—especially in close proximity to the railways and large streams—have been cut over, still there are vast areas which have not as yet been touched. The Lake Superior Paper Co. are perhaps the largest operators. Thousands of cords of spruce are required to keep their large mechanical and chemical pulp mills at Sault Ste Marie going continuously. This plant has a capacity of over two hundred tons of pulp per day and as it takes approximately one and one half cords of wood to make one ton of mechanical and chemical pulp, nearly one hundred thousands cords of spruce are used annually. The cutting of this timber gives employment to hundreds of men during the winter months at the company's various lumber camps throughout the district. Last winter some thirty thousand cords of pulp wood were purchased by a large American concern from the settlers and jobbers in the vicinity of Hearst and shipped by rail to the paper mills at Appleton, Wisconsin. Together with the operations of the above mentioned companies and several other smaller companies the total output of pulp wood for the winter of 1914 and 1915 will exceed two hundred and fifty thousand cords. Of this exceedingly large amount, one hundred thousand cords is for domestic use and the balance of one hundred and fifty thousand cords for export to the United States.

There are also several large concerns who are cutting pine timber almost exclusively. During the spring "drive" thousands of pieces of this timber are floated down the rivers and streams tributary to Lakes Superior and Huron and find their way eventually to various saw mills, where they are cut up into board lumber and



Sketch Map of District North of Sault Ste. Marie, Ont.

dimension timbers for the markets of the world. Many cords of hardwood are also cut, some of which are used in the manufacture of charcoal and the balance for fuel.

With the exhaustion of the timber supply in other localities the importance of these vast resources cannot be underestimated. The industry is practically in its infancy as yet, and as it grows, it will not only attract other new industries, which will give employment to a correspondingly greater number of men, but will also net the Province and incidentally the people of the district many thousands of dollars.

Water power—Exclusive of the forty-four thousand horse-power, which is Canada's share of the immense power flowing over the St. Mary's rapids at Sault Ste Marie, there is more than one hundred thousand horse-power in the numerous falls on the Michipicoten River and Steep Hill Falls on the Magpie River, none of which powers are being utilized. The energy is available when required and will prove a valuable asset in the development of the country.

FIRST AID TO THE INJURED AT METALLIFEROUS MINES

British Columbia was the first province in Canada to make statutory provision for compulsory mine-rescue training and equipment at coal mines, its Coal Mines Regulation Act, 1911, having included this protection for its coal-mine workers employed underground. Last year a beginning was made by the British Columbia Department of Mines to induce men employed in and about metalliferous mines to attend classes for instruction in "First Aid to the Injured," and at a meeting of the Western Branch of the Canadian Mining Institute, held in Victoria on March 11, Mr. Dudley Mitchell, of the departmental staff, informed those present that during nine months since his appointment as instructor in "First Aid" he had organized classes at a number of the larger metalliferous mines in the province and that between 400 and 500 men had attended and received instruction chiefly from duly qualified medical men acting as surgeon-instructors under the auspices of the British Columbia Council of the St. John Ambulance Association. The work had been in some measure interrupted by the closing of some of the mines, consequent on the disturbance of the metal markets by the outbreak of war in Europe, but in some mining camps, notably at Rossland, numbers of men had continued attending the instruction classes and a fair proportion of them had passed examination and obtained the St. John Ambulance Association certificate of competency to render "First Aid to the Injured." In addition, Mr. Mitchell had given instruction in the use of the pulmotor, which automatic resuscitating machine has been obtained for use in cases of emergency at the mines of the Consolidated Mining and Smelting Co., the Granby Consolidated Co., the Britannia Mining and Smelting Co., and others, not taking into account the coal-mining companies also provided with this useful adjunct to their mine-rescue apparatus.

At various meetings during the last three years the Western Branch of the Canadian Mining Institute has had papers and addresses on the subject of First Aid and, too, has given demonstrations of the use of the pulmotor. Gradually there has come about an increasing recognition of the necessity for making provision for rendering "First Aid to the Injured" to other workers than those employed in coal mines, the latter having already been benefitted by an enactment requiring that certain of the mine officials shall have obtained a "First Aid" certificate of competency. In this direction the efforts of the Chief Inspector of Mines to secure for the metalliferous miners, as well as the coal miners, as much protection as possible against unnecessarily serious results from accidents or sudden attacks of sickness until skilled medical or surgical services shall be available, have been supplemented to an important extent by the enactment recently by the Legislative Assembly of British Columbia of "An Act for the Protection of Workmen Engaged in Industrial Operations," submitted to the Provincial Legislature by the representative of a constituency on Vancouver island in which there are operating coal mines. The bill makes provision for various classes of workmen beside miners, but its effect in the cases of numerous metalliferous mines was fully recognized when it was under discussion. The act is as follows:

1. This Act may be cited as the "Ambulance Act, 1915."

2. Every employer of labor directly or indirectly operating any mine, camp, construction-work, or industry employing more than thirty persons, and being situated more than six miles from the office of a medical practitioner, shall at all times maintain in or about such industry or works at least one person possessing a certificate of competency to render first aid to the injured, and shall also provide a good and sufficient ambulance box or boxes.

3. The Secretary of the Provincial Board of Health shall determine the qualifications necessary to obtain a certificate of competency to render first aid to the injured, and any duly qualified medical practitioner may issue certificates in accordance therewith.

4. Any employer of labor directly or indirectly operating any industry or works subject to the provisions of section 2 of this Act shall forward to the Provincial Secretary the name of the person qualified to render first aid, and the number of his certificate of competency, and any employer directly or indirectly operating for more than six days without such competent person shall, upon summary conviction, be liable to a penalty not exceeding fifty dollars, and, in default of payment of such, to imprisonment for a period of not more than three months.

5. Any incompetent person presuming to possess a certificate in accordance with the provisions of this Act shall, upon summary conviction, be liable to a penalty not exceeding fifty dollars, and, in default of payment of such, to imprisonment for a period of not more than three months.

6. This Act shall not apply to coal-mines operating under the "Coal-mines Regulation Act."

7. This Act shall come into effect on the first day of January, 1916.

W. F. FERRIER HONORED BY UNIVERSITY OF ALBERTA.

At the annual convocation of the University of Alberta, in Edmonton, on April 28th, the degree of D. Sc., (Honoris Causa) was conferred on W. F. Ferrier, B. Sc., F.G.S., mining engineer and geologist, of Toronto. Mr. Ferrier was for nine years an officer of the Geological Survey of Canada, and is well known as a mineral collector. He has spent many ardent years on field work in Western Canada and the United States. He has also made extensive donations to the museum collections at the University of Alberta, and has assisted in building up the Geological Museum equipment.

PROSPECTING BITUMINOUS SAND IN ALBERTA*

By S. C. Ells.

The necessity of carefully and systematically prospecting any area of bituminous sand as a preliminary to actual development is, of course, obvious, and until this has been done it is impossible to definitely express an intelligent opinion regarding the value of a deposit. Incidentally, it may be noted that a certain degree of danger attends such work. During warm weather, large and small masses of bituminous sand flake off and fall from exposed faces. After rains, heavy slides of loosened material are frequent along the more precipitous outcrops. The following are among the more important conditions to be considered.

Overburden.

Even a casual consideration of the measurements of sections will indicate the importance that will attach to this feature, since everywhere in Northern Alberta the bituminous sand is overlaid to some extent. In certain cases, gravels and clays, in others, stratified sandstones, shales and occasional thin quartzites constitute the overburden; while, in many instances, low grade bituminous sand must also be classed as overburden, and removed as such. Moreover, contour maps of small areas in the vicinity of eleven of the more promising outcrops indicate wide variation in surface elevations, often within narrow limits.

Types of Machines, etc.—Types of machines for proving depth and character of overburden are well known, and require little comment. A simple churn drill that is being used extensively in connection with prospecting work on the iron ranges of Minnesota, is, however, here briefly referred to. Such a drill is found to be satisfactory in determining depth of overburden when the material consists of sand, gravel and clays. As illustrated in Fig. 1, the three members of the head frame, which is 30 to 40 ft. high, consist of two squared legs about 5 in. by 6 in., and a heavy ladder; the latter being of service in connection with necessary work about the upper part of the rig. Light poles, spiked to the ladder and legs, carry plank scaffolding. A $1\frac{1}{4}$ in. hemp rope supports the casing, drill, etc., also operates the 250 lb. hammer used in driving the casing. This rope runs over an 18

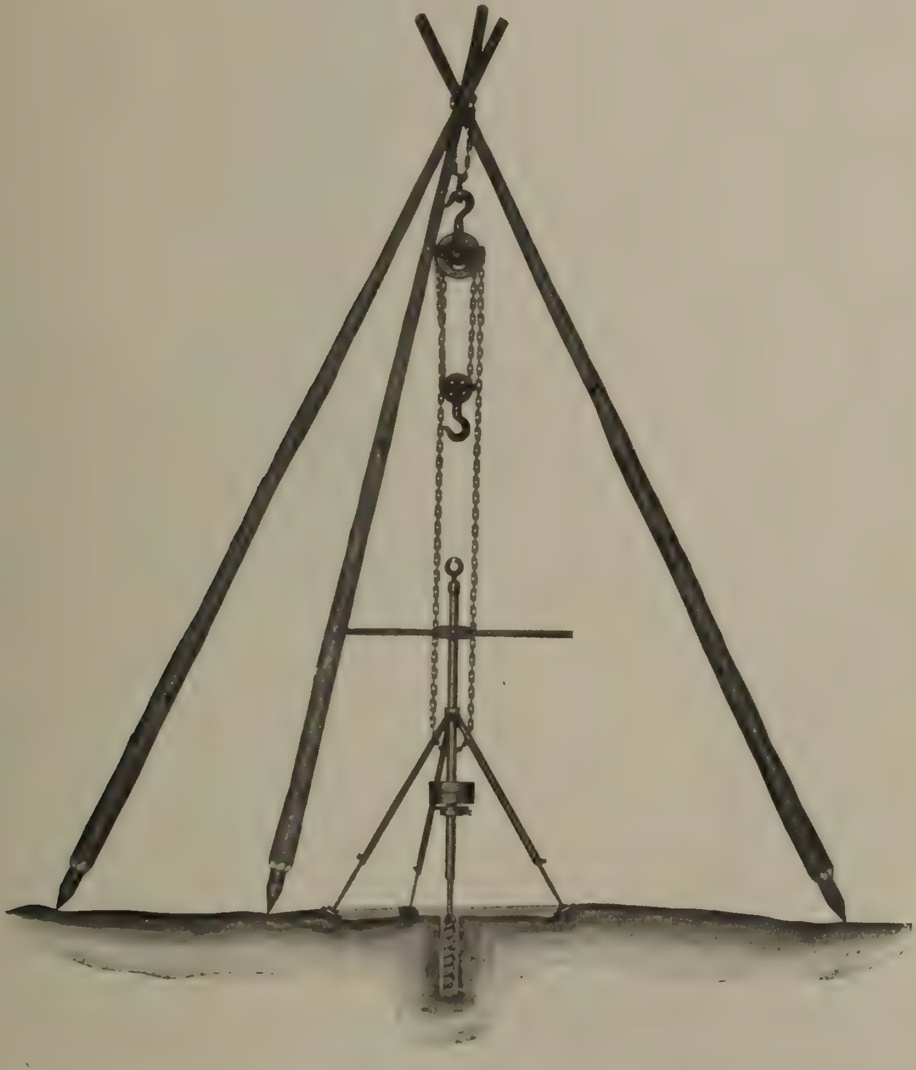


Fig. 1.—Arrangement of Auger for Boring Bituminous Sand.

*Extract from a report on the bituminous sands of Northern Alberta, Mines Branch, Ottawa, 1915.)

in. sheave placed in the upper end of the ladder, and from thence passes around a capstan as shown in Fig. 1. In driving the casing, or in operating the drill, an attendant checks or loosens the rope, and thus controls the height and frequency of the drop of the hammer.

The casing used is 3 in. heavy wrought iron, lengths being usually about 20 ft. Wash rods of $1\frac{1}{4}$ in. wrought iron are passed down through the casing, and carry a bitt at the lower end. In driving the casing a T coupling is usually screwed to the upper end in order to prevent damage by the hammer. By means of a 6 ft. bar clamped about the casing, a slow turning movement is given, which tends to prevent binding.

In commencing a hole, the casing is first driven down until it no longer sinks easily. Water is then pumped down through the wash rod, and passes out through small holes in the faces of the bitt. This water mixes with the material churned up by the bitt, and, rising through the casing, overflows at the casing head. Here the material from the hole is either wasted or run into settling boxes, for further examination. It may be noted that in soft ground, such as sand, a bitt is not required, the water merely flowing through the lower open end of the wash rod. Usually the casing is easily driven after the wash rod. In tough clay, however, it is often desirable to first spring the hole with 60 per cent. dyna-

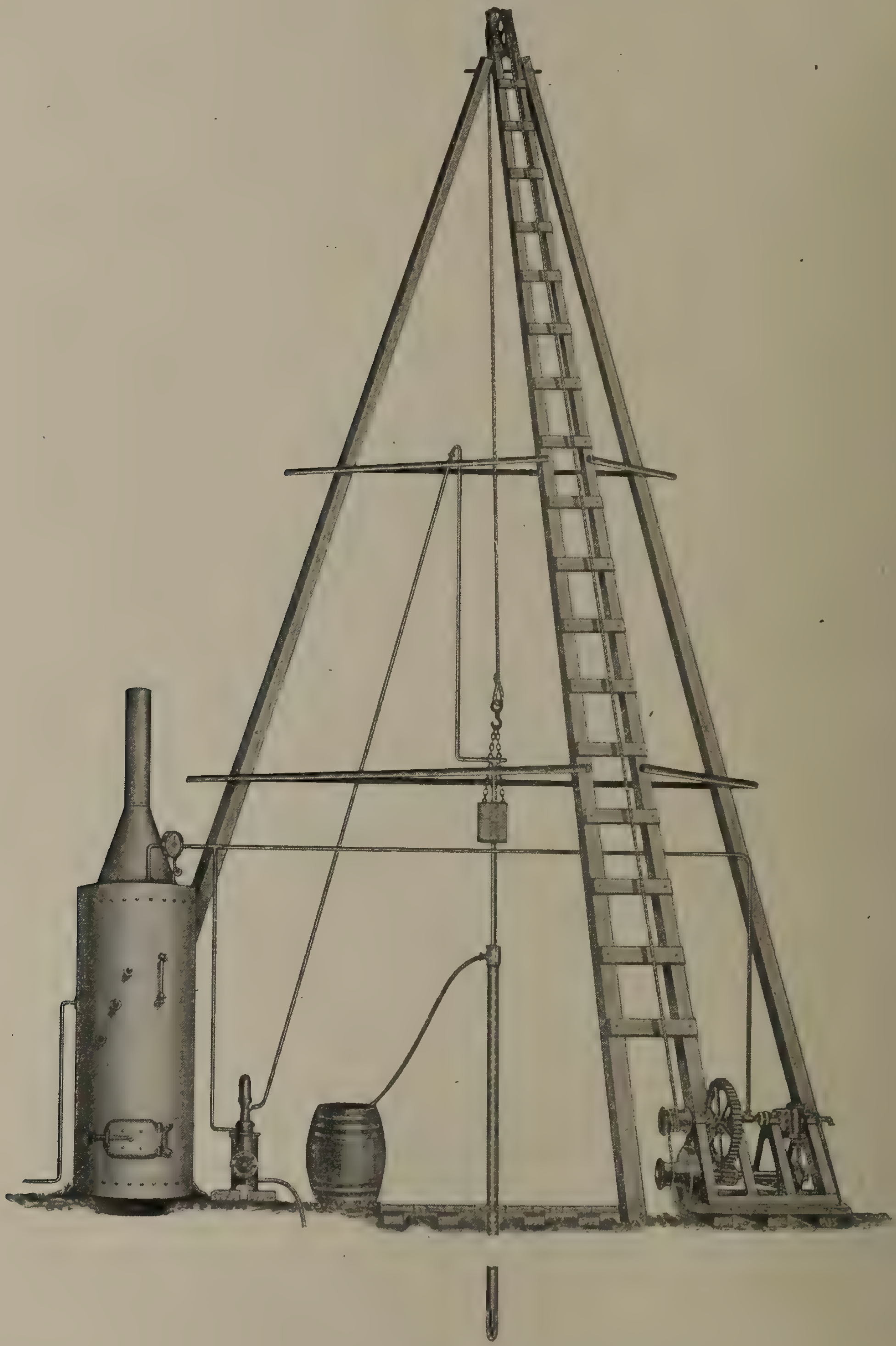


Fig. 2.—Typical Example of "Churn" Drill.

mite. Boulders when encountered are also shattered by the use of dynamite, rods and casing first being drawn up a sufficient distance. After passing through the overburden, holes may be continued, in the case of bituminous sand, by means of an auger, or other suitable appliance.

A rig such as the above can be operated by two men, though a crew of three will get better results. In favorable ground 30 to 50 ft. of hole per day can be driven.

A 10 h.p. engine similar to that shown in Fig. 1, weighs about 1,400 lb., and a 20 h.p. boiler about 3,000 lb. These are easily capable of sinking and casing holes to a depth of 150 ft. Moving with stone boat and wagon, and setting up, need, therefore, present no serious difficulty. The total cost of boiler, engine, pump, pipe, tools, etc., should not exceed $1,200. Such equipment may usually be purchased second hand at a somewhat lower cost.

Variation in Thickness of Bituminous Sand.

Owing to the general uniformity of elevation of underlying limestones, and to the undisturbed condition of much of the overlying strata, when present, the thickness of bituminous sand in any deposit within a reasonably limited area will probably be fairly uniform. The outcrops are, however, often partially concealed by drift and talus piles, which will necessitate extensive excavation before accurate measurements can be made. Frequently a portion of a bed extends below water level, in which case boring must also be resorted to.

Variation in Quality of Bituminous Sand.

Variation in per cent. of bituminous content, grading of mineral aggregate, percentages of sulphur, etc., will be met with, often within narrow, horizontal and vertical limits. Such features can only be determined by systematic sampling to the full depth of the deposit to be excavated. Two methods may be adopted, each of which will be found applicable under different conditions.

1. In sampling an exposed face, it is probable that the best results can usually be had by blasting out a vertical section. Care should be taken that such a section exposes bituminous sand in place, for, especially under heavy overburden, the effects of slips may extend several feet into the banks. Such slips are not always easy to detect, since disturbed bituminous sand, even under its own weight, will resolidify in such a manner as to leave no surface indication of any disturbance. In one instance the writer exposed a section 65 ft. high, by excavating the whole face to a depth of 5 to 8 ft. Although at first the material appeared to be in place, it was afterwards considered to be all a part of one large slip.

In connection with excavation such as the above, holes are most easily sunk by means of a special auger. The shank of this auger is 7/8 in. steel, the auger itself being 2 in. in diameter, with seven turns to the foot. The cutting edges are drawn to a chisel edge, 2½ in. diameter, and nearly at right angles to the stem. The boring rods for holes up to 20 ft. deep are of 1 in. steel, and 10 or 12 ft. lengths jointed by means of sleeve couplings, have been found convenient. In order to secure a downward pressure, circular movable weights, slotted at the side, are supported by a collar, held in place by set screws. The brake handles, 2 or 4 in number, may be held in place either by a chuck or simply by a set screw. If a set screw is used, the drilling rods must, of course, be flattened at intervals. A light adjustable tripod and collar is suggested, since considerable care is required in holding the rods at any desired angle. In order to prevent the points of the tripod from sinking into the soft bituminous sand during warm weather, thin, flat, circular metal plates may be used as indicated. In boring, it is found necessary to lift the auger at frequent intervals, in order to clear the hole. A block, suspended from a triangle of rough iron-shod poles, is therefore, suggested for this purpose. A circular leather collar, loosely fitted about the auger shaft, will prevent dirt and borings from entering the hole when the auger is lifted. A suggested arrangement for such a rig is indicated in Fig. 2. Difficulty is often experienced in boring, especially in passing through the richer beds, and all parts should be made to stand a total pressure on the brake handles of 600 lb. The occasional use of small quantities of distillate in the hole is often essential in order to "cut" the bitumen and prevent the auger sticking. Boulders or hard stratum are passed through by using a churn drill.

Whenever possible, it is obviously desirable that the bottom of the hole reach bed rock or other hard stratum. Before loading, the holes should be sprung, half a pound of 60 per cent. dynamite being used to every 25 lb. of black powder subsequently charged. Near the city of Santa Cruz, Cal., the City Street Improvement Company operates an extensive quarry in bituminous sandstone, somewhat similar to much of the material of the McMurray district. At this quarry the holes, after springing, are usually loaded with 175 lb. of black powder, a charge that will throw from the face from 280 to 300 tons of bituminous sandstone.

2. In prospecting at points where overburden is heavy, some type of light drill may be used to reach the upper limit of the bituminous sand. Beyond this, a rig similar to that shown in Fig. 2 should be used, but with the greater depth heavier rods will be required.

Finally, the following list includes the more important articles that will be required by the prospector:

Excavating tools, etc.—Shovels (long and short handles), mattocks, pick axes (extra strong), crowbars, sledges (8 lb.).

Drilling tools, etc.—Augers, drill steel, portable forge.

Exposives, etc.—Black powder, 40 per cent. to 60 per cent. dynamite, caps, fuse, battery for firing.

Miscellaneous tools, as: stilson, pipe, nut, chain and monkey wrenches, stocks and dies, cold chisels, pincers and pipe tongs, files.

Equipment for rough carpenter work, as: brace and bits, hammers and nails, chisel, saws, axes, grindstone.

Miscellaneous: rope, spare set screws, gasoline, friction top sample cans, with capacity of about 20 cubic in. Carrying boxes for all small tools and for sample cans.

INTERNATIONAL NICKEL DIVIDEND.

International Nickel has declared a dividend of 5 per cent. on the common stock payable June 1, to stock of record May 14. Previous dividends for the fiscal year ended March 31, were at the rate of 2½ per cent. quarterly, and as this is the last dividend out of the earnings for the year ended March 31, the total payment on the common stock for that fiscal year was 12½ per cent.

METALLURGICAL PRACTICE IN THE WITWATERSRAND DISTRICT, SOUTH AFRICA

By F. L. Bosqui, Johannesburg, Transvaal

(Continued from Last Issue.)

This brings me to the subject of the Nissen or single unit stamp, 16 of which have just been installed at the Modderfontein B. mill as a result of most favorable trials conducted at the City Deep in 1911. These trials incontestably demonstrated certain points of superiority of this type of stamp, showing, for example, that pound for pound of dropping weight, the Nissen stamp crushed about 30 per cent. more rock per day and had an increased efficiency of 35 per cent. over the ordinary stamp of equal weight.

The better results obtained appeared to be due to the elimination of the admittedly weak mechanical features of the older design. The serious defect of the conventional 5 stamp arrangement is that it is impossible to adjust and distribute the feed properly. It is obvious that in the multiple box all the stamps are not doing the same amount of useful work. The complex and mutually opposing currents set up within the mortar box make uniformity of feed impossible. The uncrushed ore is not distributed evenly over the dies, so that coarser pieces are not always most suitably arranged under the falling stamp. This difficulty in controlling feed is undoubtedly largely responsible for broken stems and shoe necks, and the uneven wear on dies. Another serious defect of the multiple principle is that with the long screen and the turmoil of pulp set up within the box, there is no positive discharge of the crushed ore when reduced to the desired size, and only that material adjacent to the screen can be discharged. Another obvious mechanical defect of the 5-stamp principle is that different sections of the mortar casting are subjected to continuous and rapid blows, which produce a rocking tendency, eventually loosening foundation bolts. These, if kept tight to insure rigidity, will stretch and eventually break.

The distinct advantages of the single stamp principle may be summed up briefly as follows:

1. Owing to the mortar being circular, the screen can be extended around the stamp for the greater part of the circumference of the mortar, so that it is equally distant from the stamp throughout its full length. The screen is therefore always at right angles to the direct splash of the pulp, in the most advantageous position.

2. At each blow of the stamp the pulp is forced radially against the screen, so that all particles sufficiently reduced are discharged. Owing to the mortar box being circular, each time the stamp is raised all the material in the mortar flushes to the centre, to be struck by the falling stamp. It follows, therefore, that the uncrushed ore is automatically returned to the crushing zone, so that the best conditions of feed are maintained.

3. The blow being always received in the vertical axis of the box, the mortar remains rigid on its foundation. This is noticeable in the case of the Nissen stamps at the City Deep, where, after three years of use, the box is apparently as rigid on its base as on the day it was fixed in position.

4. One of the important features of the Nissen box is that it can be cast with a minimum likelihood of shrinkage strains, which are so destructive to ordinary 5-stamp mortars. The foundation bolts give no trouble, not being subject to undue strains.

5. Another advantage of the unit principle is the more continuous operation and flexibility of the entire plant, as each stamp can be put out of commission independently.

6. An interesting feature of this type of stamp is the comparatively even and flat wear of the dies, which results from the return wash of the ore to the centre of the mortar with each stroke of the stamp, and from the increased number of rotations of the stamp due to wider cam and tappet faces.

The only objection seriously urged against the single stamp unit in South Africa is the initial cost of erection, as compared with the Californian. On the assumption that the single stamp installation required a longer mill building than a Californian for a corresponding tonnage, we should require longer bins, greater fall for launders, increased depth of pump pit and higher pump lift. But this objection is practically nullified by experience at Modderfontein B., where tonnages of 14.25 and 29 tons from Californian 1,650-lb. stamps and Nissen 2,000-lb. stamps respectively, both using 0.27 in. aperture screen (9 mesh), indicate a negligible difference in length of mill required. It is true that 2,000 lb. stamps in multiple arrangement have recorded duties as high as 20 tons; but assuming that 1,650 lb. is the economic mechanical limit for stamps arranged in series of five, the chief objection to the Nissen stamp may be regarded as unimportant. On the basis of the above data, 50 1,650 lb. Californian stamps would crush 713 tons per day; the same tonnage can be crushed by 24 Nissen stamps. The former would require a mill building 117 ft. long, if arranged in single line; the latter, 133 ft. Even if we compare the room taken up by the two types of stamp of equal weight, the disadvantage of increased length of building for single stamps in this case would be easily offset by improved efficiency.

Amalgamation.

The recovery of gold on amalgamated plates is still a very important department in Rand reduction plants, in spite of its gradual restriction in some cases to a relatively small amalgamating area, and the tentative proposals made from time to time to eliminate it altogether. It would simplify metallurgy enormously, both from a technical and metallurgical point of view, if the cyanide process could be depended upon to extract all the gold from Rand ores. In America, in recent installations, amalgamation is omitted. In these cases, however, the gold is found either (1) so finely divided, though free, that its dissolution by cyanide is sufficiently rapid and complete, or (2) it does not exist in amalgamable form. On the Rand, where we find recoveries by amalgamation as high as 70 per

ent., the greater portion of the coarse gold, variable in quantity at different mines, is only economically recoverable on plates; and there is, therefore, no likelihood of this step in treatment ever being dispensed with.

Many factors have influenced and changed amalgamation practice on the Rand. In the early days "inside amalgamation" was carried on in the spacious and specially designed mortar boxes provided with plates; but high mercury losses, the impossibility of obtaining a reliable screen sample, the inconvenience of cleaning up, and the necessity of modifying the design of mortar box to a narrower and more efficient type for crushing purposes, were the causes of the gradual abandonment of this practice. Apron battery plates are still retained in many mills, one to each battery of 5 stamps, and are of the conventional type, the average size being 5 by 12 ft., inclined to a maximum of about 1½ in. to the foot. When tube milling was introduced, making coarser crushing possible, supplementary plates were placed after the tube mills, to offset the reduced recovery from the battery plates, and to recover the gold released in the tube mills. A shaking movement was imparted to these plates, similar to that of a concentrating table, by means of hardwood springs, and an eccentric driven from a countershaft. As many as seven of these plates, 5 by 12 ft., were placed below each tube mill, set at a grade of about 10 per cent. The shaking movement was considered necessary to insure a good distribution and flow of pulp; but as tube mills became more efficient and numerous it was found that a stationary table, set at 18 per cent. grade, was quite as effective; and in many mills the tube mill plates were changed from shaking to stationary.

The practice at present is as follows: Amalgamation with and without battery plates; classification of stamp mill pulp in tube mill cones, the underflow of these going to tube mills and thence over tube mill plates; the overflow going either (1) direct to the cyanide plant, (2) to a separate set of amalgamating plates, or (3) to join the main pulp stream leaving the tube mills. It will be seen that in (1) and (2) only the tube milled pulp is amalgamated on the secondary plates, while in case (3) all the pulp passes over these plates.

This difference in practice is affected by a number of considerations. We find the Consolidated Goldfields using only three stationary plates to a tube mill, after re-classifying the overflow from the tube mill cones and by passing a considerable amount of pulp without secondary amalgamation; while the Rand mines, in their newer plants, use six tube mill plates, and bypass little or no pulp. Undoubtedly the former method is the simpler; there is less capital expenditure for plant and buildings, less capital held over in the form of amalgam, and reduced operating expense. But experience on the Rand would seem to show that it is impracticable to fix any definite limit for plate area. By restricting this area to narrow limits an increased burden of extraction is thrown on the cyanide plant, involving an irregular realization from a considerable portion of the total gold extracted, which is undesirable where the maintenance of a uniform and easily available yield is of so much importance from the point of view of mine administration. But apart from this consideration, variations in ore, as regards grade, coarse-gold content and general composition, certainly affect amalgamation; and as these factors cannot be depended upon to remain constant from month to month even for the same mine, I am of the opinion that the radical reduction in plate area recently advocated can be regarded as safely applicable only in special cases. The amalgamating facilities at Modderfontein B. may be considered a mean between the two extremes; here there are no battery plates, but 30 stationary 5 by 12 ft. tube mill plates, or a total of 1,800 sq. ft., with capacity of 39 tons of ore per plate per day. Trials have been made at this plant with a view to reducing the number of plates, but the appearance of free gold in the sand residue during these trials, and during periods when the 30 plates were overcrowded by a sudden increase of tonnage, led to the conclusion that in this instance at least any reduction of plate area would be inadvisable.

The details of amalgamation do not differ essentially from practice in other parts of the world, which has been described in a number of text books. The plates are periodically "dressed" by brushing up the accumulations of concentrate, or "black sand," with adherent amalgam, followed by the usual sprinkling with mercury and vigorous rubbing to produce the necessary uniformity and softness of surface. The operation of "scraping" is carried out once a day, usually in the morning, by means of steel scrapers, which remove the bulk of the gold accumulated during the previous 24 hours. To prevent an excessive accumulation of gold on plates, "steaming" is resorted to at varying intervals, the usual practice being to steam one-third of the plates every month, so that all plates obtain this treatment about four times a year. The procedure is to place a tight wooden cover over the plate and introduce steam until the amalgam is sufficiently softened by the heat. The plate is then scraped until only enough amalgam remains to insure a good surface. All accumulations of amalgam and "black-sand" are treated either in a grinding pan or amalgam barrel, the latter being preferred. Grinding with steel balls is carried on for about 2 hours. The contents of the barrel are then run slowly off into a *batea,* where further amalgamation takes place, the residual slimed black sand overflowing to suitable boxes, where it is retained for further treatment. All amalgam from mercury traps, launders, etc., is similarly treated. The resultant product from the grinding barrel and *batea,* when the bulk of the gold has been separated from it in the first operation, is subsequently treated in a small tube mill, whence the outflow is allowed to pass over an amalgamated plate. To recover the major part of the residual gold not saved in these two operations, the slime thus produced is treated either in separate tanks by prolonged leaching, or in a small air agitating vat, followed by decantation. By this means extractions of over 95 per cent. are obtained from this product. The tailing is sometimes discharged into the slime plant and mixed with a current slime charge.

Tube Milling.

The determination of the exact scope of the tube mills in crushing ore, and the conditions under which it would work most effectively, was not arrived at until some time after its introduction. The application of the diaphragm cone, which made possible a uniform feed of easily controllable moisture, and the introduction of heavy stamps, which permitted coarse crushing within the wide range necessary for fixing, by trial, the economic scope of the tube mill, were important factors in the development of this important auxiliary to crushing, whose value and limitations are now pretty well understood.

The obvious desideratum in distributing the work

of crushing was to ascertain the economic point of separation between stamp milling and tube milling in the production of a final product sufficiently fine to yield the maximum net profit. To determine this point of economic balance has been no simple undertaking, but has entailed a vast amount of practical investigation.

The cost of tube milling had an important bearing on this problem. The first step toward reducing operating expense was in the substitution of selected pieces of banket ore for grinding purposes, in place of the imported pebble. Then it became apparent that a tube mill worked more efficiently on coarse than on fine pulp; and the opinions of metallurgists finally converged to the now generally accepted view that the product of a 9-mesh battery screen (0.272 in. aperture) is about the economic limit of size for tube mill feed on the Rand, in producing a final product most suitable for cyaniding. Beyond this point, except in special cases, the tube mill encroaches on the domain of the stamp.

This point having been satisfactorily settled, it remained to determine the proper ratio of tube mills to stamps. At present this ratio is extremely variable, dependent upon many factors. But in new mills, the usual allowance is based upon the result of extensive trials in which all the leading groups have participated. In recent practice, the tendency has been to increase the ratio of tubes to one 22 ft. 6 in. by 5 ft. 6 in. tube mill to ten 2,000 lb. stamps, or one tube mill to 200 to 250 tons per day of 9-mesh product. At Modderfontein B. the ratio, when the sixth tube mill shall have been erected, will be one of the latter to 264 tons per day of 9-mesh battery product. At the proposed new mill the ratio will be one tube mill to seven Nissen stamps, or one mill to 203 tons of 9-mesh product per day. Latter-day practice aims at the production of certain screen grades in the various stages of reduction, which will give the most suitable final products for sand and slime treatment. The following gradings are fairly representative of the work being done at a modern plant using efficient classification and vacuum filtration:

	+60 (0.01 in.) p.c.	+90 p.c.	—90 (0.006 in.) p.c.	—200 (0.0025 in.) p.c.
Entering tube mill—				
Main circuit	85.81	8.08	6.11	....
Concentrate return..	58.30	30.87	10.83	....
Leaving tube mill—				
Main circuit	18.74	23.58	57.68	....
Concentrate return..	10.59	31.52	57.89	....
Final pulp before slime Separation.	1.40	13.87	84.73	....
Sand (39 per cent. of total ore)	9.28	38.76	40.94	11.02
Slime (61 per cent. of total ore)	....	....	10.00	90.00

(Over the period represented by above gradings, the extraction by cyanide was 93.7 per cent.).

We now come to a consideration of the more important improvements in the details of tube milling, as locally evolved. In reviewing the progress of this branch of reduction since the general adoption of tube mills by the gold mines of the Rand in 1904 to 1905, it must be confessed that divergence from the practice and design followed in the initial stages has been significant. Up to a few years ago the 22 ft. by 5 ft. 6 in. tube mill, standardized on these fields, remained almost unchallenged; and in the opinion of many, the change since introduced to greater diameter and less length has still to be justified by practical comparative tests. Modifications in methods of introducing the pulp, quantity of feed, percentage of moisture, crushing load, speed of rotation, and in methods of lining have naturally resulted as experience matured, and have all been subjects of considerable controversy here and elsewhere.

The principle of peripheral discharge, abandoned at the inception of local tube milling by reason of excessive wear on liners, went uninvestigated for many years, although the probability of its return to favor was predicted by prominent metallurgists at the time. That there was justification for this assumption has been shown recently, for as the result of trials carried out on a working scale and only lately completed at the City Deep, Ltd., a gain in crushing efficiency has been completely proved when using scoop elevators, fitted at the discharge end of the mill and passing the pulp out through the trunnion in the ordinary way.

A great deal of theoretical work has been done by various investigators in attempting to arrive at a method of comparing the crushing efficiency, or work done, by stamps and tube mills. So far, however, the production of sand of—90 grade remains the only practical standard of comparison which has been generally adopted. As the result of exchange of ideas and experience, the points of difference in local practice have gradually been brought into line, until to-day the procedure—speaking generally—may be considered uniform for standard tube mills using the ordinary central discharge.

In feed devices, the Schmitt spiral lift is now universally adopted at the more recent plants. This appliance is particularly suitable for taking the usual free underflow from the thickening cone, and can handle without difficulty the large tonnage of broken quartz necessary to maintain the load. In tonnage of dry solids fed and percentage of moisture, practice seems to have settled down to a range of 250 to 400 tons per 24 hours, depending upon the coarseness of pulp fed, with a moisture of from 32 to 40 per cent., the latter factor varying directly as the tonnage fed, within the above limits. Local considerations, however, such as physical difference in the ore itself, the occurrence and accessibility of the gold, make it necessary to modify the procedure slightly between mine and mine. Concerning speed of rotation, as the result of tests carried out locally, the tendency has been to reduce the speed to 28 rev. p. minute from the 32 to 33 considered the desideratum a few years ago, giving an average peripheral speed, using an Osborne liner, of about 400 ft. per minute.

In regard to liners, although it has been universally recognized that these have a supremely important bearing on the crushing efficiency obtainable in tube milling, the opinions of the highest authorities the world over have been at variance as to both material and design. As far as the former is concerned, owing to the extremely abrasive nature of the ore dealt with on the Rand, practice elsewhere has had little to do with shaping the final opinion now held here, as to what is considered most suitable. Beginning with shaped silex blocks, imported with the mills, shortly afterward replaced with local chert, through various stages of composite liners, composed of cement and iron, we find the majority of tube mills on the Rand to-day using the Osborne bar liner, the standard design consisting of tapered steel bars of 4 by 1¼ in. to ¾ in. section, set longitudinally, the thick edge being held in position against the shell of the mill by wedging with flat bar iron 2½

to 3 in. wide by ½ to ¾ in. thick. This has proved superior to all other liners in efficiency and longevity, the extra work accomplished being greatly in excess of the increase in power consumed. Moreover, the average variation in the internal diameter of the liner during its life is much less than with either the silex or the composite-block type, which start with a thickness of 6 in. or over.

Undoubtedly the most interesting and practical development of latter-day tube milling is to be found in the results of experiments previously referred to, which had, as their original object, the investigation of the principle of peripheral discharge. The effect of obtaining such a discharge by means of a scoop or elevator is to change the nearly horizontal line of pulp level, determined by the diameters of inlet and outlet, to a sloping line from the inlet to the lowest point in the circumference of the opposite end. Thus the mill, with the same feed and pebble load, is working on a considerably smaller pulp load, with the result that a comparatively greater grinding surface is effectively exposed, resulting, as might be expected, in an increase of production of −90 product as well as of horse power consumed. In carrying out these trials, a standard 22 ft. by 5 ft. 6 in. mill was employed, fitted with a scoop discharge, in which the radius of the lift circle could be varied. These trials were conducted in two stages: In the first, the scoop was given a maximum lift, in this case about 28 in. radius. In this series, the power consumption, wastage of pebble load, influence of feed, crushing and mechanical efficiency, were investigated. (C.E.=production of −90 in tons per mill. $M. E. = \frac{-90}{h.p.}$). In the second series, the radius of the lift circle was gradually reduced, and a comparison made with the previous results. In both trials the screening used in the stamp mill was 64 to 100 meshes to the square inch. The conclusions deducible were as follows:

1. That when maintaining the pebble load at the centre mark with feeds ranging from 250 to 400 tons per 24 hours, a 25 per cent. increase in crushing efficiency could be obtained, but with proportionately increased power consumption.

2. That within certain limits of feed, the weight of the pebble load can be decreased by 25 per cent. without affecting the crushing efficiency, with about a 10 per cent. decrease in power consumption, the mechanical efficiency showing a corresponding increase.

3. That the wear on the crushing load is increased 300 to 400 per cent.

4. That by decreasing the effective radius of the scoop from the maximum possible (about 29 in. in a 5 ft. 6 in. mill) to the ordinary trunnion discharge, a steady decrease in crushing efficiency is accompanied by a proportionate decrease in power consumption.

Considerable additional wear of liner would naturally result when running under these conditions; the ratio of the increase, however, was not determinable during the trials. Apart from the obvious fact that there is a considerable saving in head, it remains to be proved whether the lowering of the pulp level in the tube mill is best done by using an elevating scoop or by passing the pulp through openings in the periphery, as originally practised by Davidson. Locally, the former system has an overwhelming advantage, owing to the serious alteration to existing plants that would be necessitated by the latter. With the use of the pulp elevator, or scoop, the enormously increased pebble feed would have to be faced, amounting to 25 tons per mill per day. This would necessitate proper additional provision being made for sorting, conveying and feeding, which would mean a practically insurmountable difficulty in existing plants. On the other hand, the effective radius of the elevator can be reduced at will, any increase in crushing efficiency between normal and 25 per cent. being obtainable.

An interesting innovation in the design of recent plants, first introduced at the East Rand Proprietary, is the arrangement shown in Figures 3 and 5, Plate V, wherein the tube mills are placed below ground level, thus permitting flow of pulp by gravity from stamps to tube mill cones, and saving the excessive wear on pumps. This is desirable even though it entails a subsequent higher lift of finer pulp, more suitable for pump elevation.

The latest design of tube mill used by the Rand Mines (Fig. 4) includes a ball chamber interposed between the main crushing section of the mill and the outflow trunnion. This chamber is provided with a cast-iron step lining bolted to the shell, and the grinding medium used is 10 lb. steel balls, of which about 20 are required. The object of these balls is to reduce the small spent pebbles which are being continually rejected by the mill. The usual practice is to remove these from the pulp by means of a trommel fixed to the discharge trunnion, and periodically convey them to the stamp battery. The ball chamber is very effective in doing away with this nuisance, and has not been found to reduce the grinding efficiency of the mill, owing evidently to the additional work done by the balls, nor do the balls wear out unduly.

(To be continued.)

MR. SCHWAB, UNDER PRESSURE.

No man of metal amounts to anything until he has been under pressure. Charles M. Schwab has received relatively as much hammering as a Bethlehem Steel armor plate for a warship.

Samuel Untermyer has fought Charles M. Schwab upon more than one occasion. The only way Untermyer could square the account was to retire each time and buy some more Bethlehem Steel for the bottom of his strong box for his grandchildren.

Ten years ago, in the Evening Mail building, Charles M. Schwab was on the witness stand before the legal guns of Samuel Untermyer.

"Are you the man behind the gun?" said the lawyer of iron nerve to the man of steel construction. There was no answer.

"Are you the real thing in Bethlehem Steel?" And still there was no answer.

"Do you understand the English language?" snapped forth the limb of the law.

Straight as a gun barrel came the answer:

"I do when I hear it."

Then came the plain question:

"Do you hold the controlling interest in Bethlehem Steel?"

And straight and clear came the answer:

"I do."—Boston News Bureau.

CASEY-SENECA.

S. Harry Worth, president of the Seneca-Superior, and R. F. Segsworth, treasurer of the same company, have taken an option on a block of treasury stock of the Casey-Seneca Silver Mines, Limited, a company recently formed by Mr. Herbert Murray, of Haileybury, to hold the title to his claim adjoining the Casey mine in Harris Township. The funds necessary to prospect the property are being raised by private subscription.

METHOD FOR THE DETERMINATION OF GOLD AND SILVER IN CYANIDE SOLUTIONS*

By L. W. Bahney.

Many methods for the determination of gold or silver, or both, in cyanide solutions have been published, which with care in manipulation, and modification in some cases, will give results that are satisfactory. It is possible to classify or group these methods as follows:

1. Evaporating the solution in a porcelain or agateware dish containing litharge (1), or in a "boat" made of lead foil.
2. Forming a lead sponge containing the precious metals by means of zinc shavings (2), zinc dust (3), or a piece of aluminum (4).
3. Decomposing the cyanide solution with an acid and precipitating the precious metals by the use of one or a combination of some of the following: Copper sulphate (5), sodium sulphite (6), hydrogen sulphide (7), cement copper (8).
4. Precipitating the silver by zinc dust held in a Gooch crucible and determination with a standard solution of sulphocyanate (9).
5. Electrolysis (10).
6. Colorimetry (11).

Eliminating group 4 because of its applicability to silver solutions only; group 5, because of the time and apparatus required; and group 6, because of the skill required, and the difficulty of maintaining the standards; which method of the remaining groups will give accurate results in the shortest time?

In the Hammond Laboratory of the Sheffield Scientific School, where many ores are tested for treatment by the cyanide process, the resulting solutions will cover a wide range, when their contents of base metal compounds are considered, and it is in the laboratory work just as much as in mill work that a reliable method that will not require too much time is needed. This is especially important in teaching.

What criticism I have to make has been brought about by doing what every operator does—trying the various methods to find the one that will give "good results."

Group 1 requires too much time; a large hot-plate surface if many determinations are to be made; scraping of the dishes clean to remove all particles; breaking up the mass; fluxing and fusing in a crucible. Evaporating in a lead boat is uncertain, because some lead foil may be quite thin and perhaps pitted, so that the solution will leak through as the evaporation proceeds and the cyanide solution becomes concentrated.

1. T. Lane Carter: Engineering and Mining Journal, vol. lxxiv, No. 20, p. 647 (Nov. 15, 1902).
2. Alfred Chiddy: Engineering and Mining Journal, vol. lxxv, No. 13, p. 473 (Mar. 28, 1903).
3. W. Magenau: Mining and Scientific Press, vol. xcii, No. 15, p. 259 (Apr. 14, 1906).
N. Stines: vol. xcii, No. 17, p. 278 (Apr. 28, 1906).
H. L. Durant: Proceedings of the Chemical, Metallurgical and Mining Society of South Africa, vol. iii, pp. 105 to 111 (1902-03).
4. T. P. Holt: Mining and Scientific Press, vol. c, No. 24, p. 863 (June 11, 1910).
5. A. Whitby: Proceedings of the Chemical, Metallurgical and Mining Society of South Africa, vol. iii, p. 6 (1902-03).
6. J. E. Clennel: Cyanide Handbook, p. 443 (1910).
7. Henry Watson: Engineering and Mining Journal, vol. lxvi, No. 26, p. 753 (Dec. 24, 1898).
8. Albert Arents: Trans., xxxiv, p. 184 (1904).
9. G. H. Clevenger: Engineering and Mining Journal, vol. xcv, No. 18, p. 892 (May 3, 1913).
10. Miller: Proceedings of the Chemical, Metallurgical and Mining Society of South Africa, May 16, 1905.
11. James Moir: Proceedings of the Chemical, Metallurgical and Mining Society of South Africa, vol. iv, p. 298 (1903-04).
A. Prester: Proceedings of the Chemical, Metallurgical and Mining Society of South Africa, vol. iv, p. 385 (1903-04).

*A paper published in the Bulletin of the American Institute of Mining Engineers, February, 1915.

Group 2 includes the method suggested by Alfred Chiddy and others that are modifications of it.

The idea of the formation of a lead sponge to contain the gold and silver as suggested by Chiddy is a clever one, and it appealed to every one having anything to do with cyanide solution. To be able to remove from the dish a small sponge of lead that could be cupeled was a great advancement in the work. It is difficult to get good results if it is followed as printed (2), so that its modification as suggested by Stines, Magneau, Holt and others is a natural outcome. Any of the methods of this group that will give a sponge of closely cohering lead, containing all the gold and silver, in a reasonable time, is a "good one"; but when the sponge breaks into small pieces they must be collected in some manner and filtration is the next step.

When the lead has been collected on a filter paper it then becomes necessary to scorify or dry the paper and reduce it in a crucible with the necessary fluxes.

It has seemed to me that it is right here that an opportunity exists for a new method, either for the formation of a good sponge or to save the broken sponge formed by any of the other methods, and at the same time eliminate scorification.

Group 3 includes all those methods that permit the use of a large quantity of solution and from which the precious metals may be precipitated as mentioned above. Whether it is necessary to use so large a quantity, aside from experimental work perhaps, I shall leave to the individual operator. My own objections to this group are: The quantity of solution involved; the time required; and the necessity of filtration and scorification.

In order to present this new method clearly I have numbered each successive step in making the determination and have included the photograph to show apparatus, etc.

I. Procedure of New Method.

1. Into a 250 c.c. beaker (No. 2 low form) pour 5 assay tons (146 c.c.) of cyanide solution.
2. Add 20 c.c. of a 20 per cent. solution of lead acetate.
3. Add 15 c.c. of concentrated hydrochloric acid.
4. Place a ¼ in. rod of zinc in the beaker.
5. Place the beaker on a hot plate—bumping does no harm if it will not break the beaker by raising it off the plate.
6. As soon as the solution boils, leave it so for 5 minutes; then remove from hot plate.
7. Fill with cold water; then decant about half and again fill with cold water.
8. Twist the zinc rod quickly between the finger and thumb and draw it out of the sponge.
9. If any small particles of lead are left adhering to the rod at about where the top of the solution touched it, draw the sponge up the side of the beaker with a glass rod.
10. Touch the zinc rod to the sponge to free the particles.
11. Wash the sponge three or four times with cold water to remove zinc chloride.
12. Press it against the side of the beaker with a glass rod to remove the water.
13. Decant the water and wash again.
14. Place the dewatered sponge on a piece of sheet lead 2 in. square, then fold it. It is now ready for cupellation.

II. Procedure When the Sponge Breaks.

When the sponge breaks into large pieces it is possible to unite them by pressing together with a glass rod. If there are many small particles it may not be possible to unite them by pressing together. Then this method is suggested:

15. Fit a 2 in. funnel into a filtering flask.
16. Cut a piece of sheet lead 3 in. square; fold as you would a filter paper.
17. Cut off the corners; then open it to fit the funnel.
18. Place about 5 g. of test lead in the lead cone and push it down with the finger, then smooth out the folds and creases so that it will fit well.
19. Lift it from the funnel and prick seven or eight holes in the apex or point by means of a pin, then put it back in the funnel.
20. Complete 9 and 10; then start the filter pump.
21. Tip the beaker and draw most of the lead sponge into the lead cone by means of a glass rod (without a rubber tip).
22. Pour the remainder of the solution in the cone, rinse beaker and wash contents of cone three or four times.
23. Tamp the lead down with the flat knob of a glass rod.
24. Stop suction, remove cone from funnel and fold it carefully. It is now ready for cupellation.
25. Draw a hot cupel to the front of the muffle and place the cone in it. When the water has been driven out, push the cupel into a hotter part of the muffle and finish the cupellation in the regular manner.

IV. Notes and Comment.

The generation of hydrogen along the zinc rod is sufficiently active to prevent the adherence of the lead. A strip of aluminum does not work so well.

The method has been used in the assay of a number of solutions containing a variety of base metal compounds and in each case the sponge remained whole. With solutions from cobalt ores that contain much silver the sponge is apt to break.

The amount of time as given in the table will vary with the heat of the hot plate—those given are averages.

In order to keep the weight of the lead to be cupelled down to a minimum, thin sheet lead should be used.

A cone as described in 16 and 17 will correspond to a filter paper 7½ cm. in diameter and, made of heavy sheet lead, will weigh about 7 g.

The pin holes should always be as near the point as possible.

A screen analysis of the test lead used in developing this method is as follows: + 30, 7.0 per cent.; + 60, 28.6; + 100, 23.2; — 100, 41.2 per cent.

It is quite possible to have a cone manufactured as are bottle caps. This would lessen the weight about 50 per cent.

V. Scorifying the Precipitate.

The following method may be used for scorifying the precipitate obtained by any of the methods of group 4:

26. Collect the precipitate in a 9 cm. filter paper; wash it down into the point.
27. Make a cone from a disk of sheet lead 3½ or 4 in. in diameter.
28. Punch 10 or 12 holes at the point.
29. Fold the filter paper into a small wad and place it in the point of the cone.
30. Pour on top of the paper 10 g. of test lead.
31. Fold the lead cone so as to include its contents and place it in a glazed scorifier at the mouth of the muffle.
32. When the paper has become dry and begins to char, the gases will burn as they come from the pin holes. As soon as the flame ceases place the scorifier in a hotter part of the muffle. The lead cone will hold the paper firmly while it is burning; so there is no danger of its unfolding and scattering the precipitate.

COPPER.

One of the largest copper producers tells the Boston News Bureau:

"We made a very large sale Wednesday—millions of pounds—at 19 cents, and this price has been bid us for deliveries extending so late in the year that we have declined the sale."

Another very large seller says:

"The companies for which we sell are more than 100 days sold ahead, and we are daily taking contracts at 19 cents per pound for electrolytic."

The heavy sales of copper booked by producers during April by no means covered requirements of manufacturers in the United States handling war orders and those abroad working on similar orders. Inquiries now in the market call for many millions of pounds to be delivered further ahead than most producers care to sell.

One of the most important inquiries in the market this week for the account of a foreign government, understood to be Russia, called for 15,000 tons of copper, 10,000 tons of spelter and 5,000 tons of aluminum. Deliveries were desired during the next six months. Among copper people who had been visited in this connection the opinion was expressed to the Boston News Bureau that while the tonnages would doubtless be secured, it might be necessary to do considerable "shopping," particularly for the spelter.

Another buyer wants a large amount of copper to be delivered from November to May, 1916. This likewise, is for export.

Some of the producers have refused to book copper beyond September. Others have gone into the first half of 1916. The demand for copper has been genuinely large, all producers admit and the price advance to 19 cents a pound for electrolytic has been fully warranted by trade conditions.

The Granby Consolidated Co. again has in operation all of the eight blast furnaces at its copper-smelting works at Grand Forks, B.C. Smelting was suspended there last August, shortly after war was declared between Great Britain and Germany; two furnaces were blown in toward the end of the year, and others were added until, on April 19, the full battery was running once more.

The steel plant of the International High Speed Steel Company, at Rockaway, N.J., is now rapidly nearing completion, and it is expected that it will be in full operation by the latter part of June. The product will be confined to the highest qualities of tool steels, alloy steels, high speed steels of all shapes and sizes, solid octagon and cruciform, and hollow hexagon and round rock drill steels, for which the company has already achieved an enviable reputation in its famous "Bulldog" brand.

CANADA COPPER CORPORATION, LIMITED, ANNUAL REPORT, 1914

The first annual report of the Canada Copper Corporation, Ltd., which has mining properties in British Columbia and its head office in New York City, has been issued. Under date of April 16, 1915, the chairman, Mr. Newman Erb, reported as follows:

Report of Chairman.

"This company was organized in March, 1914, with an authorized capital of $5,000,000 divided into 1,000,000 shares of $5 par value. As of December 31, 1914, there were outstanding 600,200 shares, leaving unissued 339,800 shares, 200,000 of which are held for conversion of debentures.

"At the time of the organization of the company, there were authorized 1,000,000 six per cent. convertible debentures, of which there were outstanding as of December 31, 1914, $600,000. The remaining $400,000 of debentures and 199,800 shares of stock may be issued for future requirements.

"Under the plan of organization, stockholders of the British Columbia Copper Co., Ltd., were invited to subscribe to the debentures of your company, and at the same time to exchange their shares for shares of the Canada Copper Corporation. There were so exchanged 444,952 shares of British Columbia Copper Co. stock, now owned by your company, and the balance of 155,048 shares and $155,048 par value of debentures were taken over by the underwriters.

"There has been loaned to the British Columbia Copper Co., Ltd., to December 31, 1914, $340,000 against that company's notes, secured by a first mortgage, which funds have been expended for the purchase and development of the properties under option.

Report of General Manager.

"The actual production period at the mines and smeltery was confined to eight months of the year, the plant having been shut down shortly after the outbreak of the European war in August.

"The ore shipments from the mines were as follows:

Mines.	Tons.
Mother Lode, Boundary, B.C.......	178.049
Queen Victoria, Nelson, B.C........	7.920
Napoleon, Washington	5.332
Lone Star, Washington	1.988
Total........................	193,289

"**Mother Lode Mine**—In the month of May, it became possible to ship two classes of ore from this mine, one class coming from the glory-hole section and the other from the new orebody in the south end of the property. Below are given average assays and analyses of the ore before separation was effected. A representing four months' shipments; B the 'mine-run' ore after it was separated; and C the ore coming from the south end of mine:

Class.	Quantity Tons.	Gold Oz.	Silver Oz.	Copper Per Cent.
A.........	102,536	0.0275	0.149	0.862
B.........	69,703	0.0363	0.178	0.868
C.........	5,810	0.0950	0.167	0.396

	Silica. P. C.	Iron. P. C.	Lime. P. C.	Sulphur. P. C.
A.........	34.65	15.36	20.01	2.37
B.........	31.30	17.85	18.75	3.37
C.........	21.20	28.60	11.95	13.20

"Numerous rock falls occurred during the year, due to the heavy blast set off in September, 1913. The waste rock became mixed with the ore and was to a large extent removed by hand-picking from a conveyor belt. More than 25 per cent. of the material hoisted through the shaft was put over the dump as waste. While this maintained the grade, it raised the costs correspondingly.

"Diamond drilling disclosed the presence of a new orebody in the southern end of the Mother Lode claim, and extending into the Primrose claim, also one of the company's properties. Two levels, the 200-ft. and the 300-ft., were extended and driven under this ore, connections were made between levels, and stoping was begun as quickly as possible. No attempt was made to block out ore.

"Raises were started from the 200-ft. level, north, to tap an orebody known to exist in the northern end of the glory-hole. Aside from this, the usual drifts, crosscuts, and raises were put in to facilitate the extraction of the ore broken down by large blasts. The distances driven were as under:

	Ft.
Drifts and crosscuts	1,175.5
Raises............................	1,420.3
Diamond drill holes	4,852.0

"Costs.—The cost of placing the ore on the railway cars at the mine was $0.8548 a ton. This is higher than usual; it is in part accounted for in that all construction work was charged to operating expense, and by the following special items:

	Ton Ore	Ft.
Ore sorting	$0.0455	
Development...........	0.0870	$5.968
Diamond drilling	0.0648	2.378

"Ore Reserves.—The figures given are estimates and not the result of actual measurements of orebodies. The mine is in such condition that it is not possible to measure broken ore in the mine-chutes and in the glory-hole. The new orebody in the south end of the property was not opened to expose quantity, but to furnish an immediate ore supply to the smeltery. It is more than likely that a greater amount of ore than that given in the estimate will be taken from this part of the mine. However, future work will determine this.

"Near the shaft and under the hoist are pillars and arches of good ore, which may be extracted if the hoist be moved to the opposite side of the shaft. The cost of making this move is estimated to fall within $3,000. In the northern end of the glory-hole are two bodies of good ore which can be reached by raises from the 200-ft. level. The broken and shattered material in the glory-hole may be extracted, provided the hanging wall does not cave in. Should this happen, a new set of raises from one of the lower levels might still recover a large portion of this material. The following is an estimate of ore available under favorable conditions:

	Tons.
In mine chutes	15,000
In north end of glory-hole	75,000
In glory-hole section	100,000
Arches and pillars below hoist	65,000
New orebody, south end	60,000
Total	315,000

Prospecting by diamond drills has failed to disclose an extension, in any direction, of the main Mother Lode orebody. The new discovery in the southern end of the property seems to be a separate orebody. It has a general dip to the northeast, and crosscuts from the 300-ft. level would determine its extent at that depth.

"**Napoleon Mine.**—This mine was closed in May, there not having been any farther call for its ore for the Greenwood smeltery. The ore shipped during five months amounted to 5,332 tons; its average grade was gold .0547 oz., and silver 0.0807 oz. to the ton, copper 0.204 per cent., silica 20.3 per cent., iron 35.3 per cent., lime 5.3 per cent., sulphur 17.7 per cent. Mining, freight, and general expense amounted to $2.8575 a ton at Greenwood smeltery.

"The remaining available ore is estimated at 33,000 tons and consists of floors of stopes.

"**Queen Victoria Mine**—Work was suspended at this property in March. The price of copper having steadily declined and the grade of the ore become so low, it could not be shipped to Greenwood at a profit. The costs were $3 a ton f.o.b. cars at the smeltery; the grade of the ore was as follows: Gold, trace; silver, 0.36 oz. to the ton; copper, 1.268 per cent.; silica, 36.8 per cent.; iron, 14.17 per cent.; lime, 24.75 per cent.; sulphur, 2.07 per cent. Shipments of ore totalled 7,920 tons.

"**Lone Star Mine.**—The work carried on at this property was largely exploratory. Operations were suspended entirely in May. Some ore was extracted and sent to the smeltery at Greenwood and a small amount of milling ore was delivered to the experimental mill at Boundary Falls, B.C., for testing purposes. The smelting ore shipped amounted to 1,988 tons; it was of the following grade: Gold, 0.03 oz., and silver 0.225 oz. to the ton; copper, 2.423 per cent. The milling ore yielded 16.22 tons of table concentrate which gave the following assay: Gold, 0.17 oz., and silver 0.62 oz. to the ton; copper, 10.65 per cent; silica, 24 per cent. Experiments show that this ore could be treated by wet concentration on tables, afterward passing the middling and tailing, after regrinding, through a flotation unit. The tables yielded about 35 per cent. of the entire metal value in the form of concentrate. The flotation tests were made with a laboratory 'slide machine,' and were not commercial, but it is safe to say that practically the same results can be obtained in milling on a large scale.

"The ore reserves consist of two separate orebodies, containing together about 175,000 tons of ore of the following grade: Gold, 0.03 oz. and silver 0.2 oz. to the ton; copper, 1.70 per cent.

"**Eureka Group.**—This property is situated a few miles from Nelson, B.C. It was held under option by the company. Developments did not warrant the payment of the purchase price, and the option was relinquished in July.

"**L. H. Group.**—This is another property, worked under option to purchase, which did not come up to expectations, and, as no reasonable concession could be obtained from the owners, the option was allowed to lapse early in the year.

"**Wellington Camp.**—The Butte claim was taken under option and some surface exploration, in the way of shallow pits and shafts, was done. The results did not warrant the expenditure, therefore the option was forfeited in April.

"**Emma Mine.**—The company owns a three-quarter interest in this property, which has been idle since a fire destroyed its headworks in 1912. The ore is high in oxidized iron and contains copper and gold. The quantity of ore is estimated at about 65,000 tons.

"**Smelting Operations.**—The smeltery was not operated to full capacity, due to shortage of custom ore. This, in connection with the low price of copper, early in the year made it apparent that it was a question of very little time before operations must cease entirely. The furnaces were blown out on August 23 and the plant cleaned up as far as practicable.

"The total quantity of ore smelted from January 1 to August 23 was 299,928 tons, consisting of British Columbia Copper Co.'s ores 193,512 tons, and custom ores 106,416 tons.

"The amount of converter slag made and smelted was 5,129 tons; it contained 1,627 tons of custom ore and 466 tons of clay.

"The amount of coke used was 41,026 tons. This represented 13.52 per cent. of the entire charge fed to the furnaces.

"The time of actual operation was 450 furnace days. The total amount of charge smelted ex-coke was 303,430 tons, or amount of charge smelted per furnace day 674 tons.

"The average grade of matte was 39.7 per cent. copper. The blast furnace slag contained 0.251 per cent. copper, 0.0039 oz. gold, and 0.07 oz. silver a ton. The average analysis was: Silica, 41.9 per cent.; iron, 18 per cent.; lime, 22 per cent. The recoveries, based on blister copper returns, slag losses, and metals tied up in process, showed as follows: Gold. 101.39 per cent.; silver, 75.48 per cent.; copper, 77.27 per cent. The production of metals was: Copper (fine), 4,116,190 lb.; gold, 14,442.28 oz.; silver, 63,501.27 oz.

"**Copper Mountain.**—At this camp, which is situated approximately 130 miles west of Greenwood, and 14 miles by wagon road, south of Princeton, Similkameen, B.C., the company has been carrying on a campaign of prospecting and development by diamond drilling and trenching. The ore occurring here consists of a mineralized grano-diorite, which has been intruded by quartz-porphyry dikes. The latter comprise a rather intricate system. Considerable work was done during the year to determine the location of these dikes, thereby avoiding drilling non-mineralized ground.

"Until August there were four drills in operation, and an average of 91 men employed daily. Since that time the working force has been reduced to an average of 28 men a day, with one diamond drill still being operated.

"Systematic trenching has been done to the extent of 18,315 ft. for the year. Owing to heavy overburden, some of the trenches reached a depth of 35 ft. The amount of diamond drilling for the year was 28,134 ft.

"Ore Estimates.—The ore developed to date is computed from diamond drill holes, trenches, pits, and underground work such as shafts and drifts. A classification has been made as to the situation of the several orebodies, some of them following a more or less regular northwesterly-southeasterly course, while others are scattered. The latter are designated 'outlying orebodies.' A further distinction is made as to ore occurrence, namely, that which is 'reasonably assured'

and 'probable' ore. The latter consists of sections adjacent to or between orebodies of known depth and value, and under good surface showings; or favorable situations which have been partly proved by one or more ore-bearing diamond drill holes.

"Our engineers estimate the amount of 'reasonably assured' ore at 4,523,763 tons, of the following grade: Copper 1.82 per cent., gold 0.013 oz., and silver 0.24 oz. a ton. In addition, there is estimated to be in this same section 1,675,000 tons of 'probable' ore of a similar grade. The 'outlying' orebodies show 'reasonably assured' ore to the amount of 405,170 tons, containing 1.54 per cent. copper, and 0.013 oz. gold and 0.14 oz. silver to the ton. The probable ore in this section is estimated at 345,000 tons of a similar grade."

Balance Sheet, Canada Copper Corporation, Ltd.

The Balance Sheet, as at December 31, 1914, shows the following Liabilities and Assets:

—Liabilities—		
Capital stock (authorized, $5,000,000) issued		$3,001,000.00
Debentures (authorized $1,000,000), issued		600,000.00
		$3,601,000.00
—Assets—		
Investment, British Columbia Copper Co., stock		$3,000,000.00
Notes receivable, secured by mortgage		340,000.00
Interest accrued on notes		8,216.67
Mining property		9,394.73
Incorporation, legal and general expense	$53,271.30	
Debenture coupon No. 1	18,000.00	
	$71,271.30	
Less interest received	8,988.98	
		62,282.32
Cash on hand		181,106.28
		$3,601,000.00

BRITISH COLUMBIA COPPER CO., LIMITED

Under date April 15, 1915, the directors of the British Columbia Copper Co., Ltd., have submitted to the shareholders their report, together with the certified Balance Sheet and Profit and Loss account, for the year 1914. The report follows:

On account of the unsettled condition of the copper market, incident to business disturbances in the latter half of the fiscal year, the company's smeltery at Greenwood, Boundary district, and operations at the mines from which the ore supply had been drawn, were suspended last August, but the development and exploration at Copper mountain, Similkameen, were continued in a restricted way in order to conserve your company's resources.

The ore shipments from the company's mines tributary to the smeltery at Greenwood, were as under:

	Tons.
Mother Lode mine, near Greenwood	178,049
Queen Victoria mine, near Nelson	7,920
Napoleon mine, State of Washington	5,332
Lone Star mine, State of Washington	1,988
Total	193,289

The more important work done was in the further exploration and development of the properties acquired and under option on Copper mountain, where to the end of the fiscal year there has been disclosed 6,200,000 tons of reasonably assured and probable ore of an average grade of 1.82 per cent. copper, and in addition to this, there is some 750,000 tons of ore of a lower grade, namely, 1.54 per cent. copper.

The company expects to, in the coming fiscal year, continue work, but on a larger and more aggressive scale, hoping thereby to add materially to the ore reserves already disclosed.

It is intended, when the work shall have made further progress, to arrange for the permanent improvements and equipment for treating these ores.

There are options outstanding on eleven mineral claims at an aggregate cost of $188,000 and payments have been made on these options totalling $52,545.84. There were twelve other claims under option, but the result of prospecting having proved unsatisfactory those options were permitted to lapse. There has been expended upon development during the fiscal year $183,203.96.

As shown in the balance sheet herewith, this company has borrowed from the Canada Copper Corporation, Ltd., $340,000, to December 31, 1914.

The company's engineers recently made a preliminary valuation of the company's mining and smelting properties and the value shown in the balance sheet is based on their report. The amount written off for property in the Boundary district and the Lone Star and Napoleon properties in the State of Washington, including the stock and bonds of the New Dominion Copper Co., Ltd., is $1,781,095.20, leaving the present book value of $1,377,431.22. The Copper Mountain properties are shown on the books at a present valuation of $2,022,568.78, making a total of $3,400,000, as shown in the balance sheet.

The above-mentioned transaction has reduced the balance as shown in Profit and Loss account December 31, 1913, by approximately $500,000, leaving balance to Surplus account, December 31, 1914, of $23,530.45.

The management is again indebted to the intelligent co-operation of its operating force under unusually adverse conditions.

Profit and Loss Account.

Operating disbursements—	
Mining, smelting, freight, refining and selling charges, general office and administration expenses, maintenance and fixed charges and expenses incurred during the time the plant was closed	$788,684.64
Custom ore purchased	162,434.84
	$951,119.48
Proceeds of metal shipments	$899,851.17
Miscellaneous earnings	11,503.76
Balance, being loss for the year	39,764.55
	$951,119.48

Balance Sheet.

—Liabilities—

Capital Stock—	
Authorized $3,000,000 in 600,000 shares of $5 each; issued, 596,709 shares, less 5,000 shares in treasury; 591,709 shares of $5 each	$2,958,545.00

Accounts payable		146,704.54
Loans and advances from banks		58,794.04
Canada Copper Corporation—		
Amount advanced on mortgage	$340,000.00	
Accrued interest thereon	8,160.00	
		348,160.00
Reserve for sundry liabilities.	$500.00	
Reserve for employers' liability	5,016.76	
		5,516.76
Surplus		23,530.45
		$3,541,250.79

—Assets—

Properties, equipment, shares and bonds in other companies, etc.	$3,400.000.00
Metals and smeltery products, supplies, etc.	112,801.23
Prepaid insurance and taxes	4,693.00
Sundry debtors	6,567.19
Cash on hand and in banks	17,189.37
	$3,541,250.79

CANADIAN COLLIERIES (DUNSMUIR), LIMITED

At the annual meeting of the Canadian Collieries (Dunsmuir), Limited, held in London on March 19, the affairs of the company were fully discussed, and resolutions were unanimously adopted waiving the default the company had made on September 1, 1914, and March 1, 1915, in payment of interest on its bonds. This waiver covers a period of three years, that is, until March 1, 1918, or, as the resolutions put it, "to the half-yearly date for payment of interest upon the bonds occurring next before the expiration of one year from the formal conclusion of peace between Great Britain, on the one hand, and Germany and Austria, on the other hand (whichever period may be the longer.) Then the bond interest shall be payable only as and when and to the extent that the net profits of the company as certified by the auditors of the company for the time being are sufficient to pay the same, any arrears of such interest being nevertheless carried forward and paid out of the net profits of any subsequent year."

The reasons for this and other modifications of the trust deed of August 6, 1910, securing the 5 per cent. first mortgage gold bonds of the company were fully explained at the meeting. As the chairman pointed out, there were the following alternatives open to the bondholders: First, they could put in a receiver; second, they could commence the foreclosure of their mortgage, and third, they could waive the defaults and extend the time for payment of the bond interest. The last-mentioned alternative was unanimously adopted, and to that end the meeting appointed a committee of five of the bondholders, and in this committee was vested a voting trust giving it entire control over the administration and management of the company. The five members are: Messrs. Stanley Carr Boulter, Robert Henry Benson, David Augustus Bevan, John Ashley Mullens, Jr., and Ernest Guy Ridpath.

The full report of the meeting includes many interesting features. Mr. W. E. Rundle, general manager of the National Trust Co., Ltd., the trustees for the bondholders, presided at the meeting. During the discussion he stated that "Sir William Mackenzie (of Mackenzie & Mann, of Toronto, at the head of the Canadian Northern and Canadian Northern Pacific Railways), is not now a director of the National Trust Co., but Messrs. E. R. Wood and F. H. Phippen are directors. He added that out of 22 directors of the National Trust Co., there were but two who were also directors of the Canadian Collieries Co., and he gave assurance that those two had not at any time attempted to influence the mind of the trustees with regard to anything arising out of the trusteeship; also, that the national Trust Company had ably administered this trusteeship. So far as the National Trust Co. is concerned, the chairman stated that it has not any interest in the Canadian Collieries Co. save as trustee; nor does it own a dollar's worth of bonds or stock in the Collieries Co., nor any stock in the Canadian Northern Railway.

Mr. H. S. Fleming, the chairman of the executive committee of the Canadian Collieries Co., who had journeyed from Vancouver Island, British Columbia, to attend the meeting, explained at length the causes leading to the present condition of the company. After reviewing the two years' strike of the miners, he referred to the trade depression, and in this connection said: "To show you the very direct effect which this has had on the position of the company, I may tell you that during last winter the total consumption of domestic coal in the city of Vancouver was barely one-half of what it had been two years before. This, of course, affected all the coal mining companies on the British Columbia coast, but the Collieries Co. most, for the reason that it is the largest. The use of coal for industrial and public purposes had been similarly cut down. Then, the war disorganized shipping and there was and is little demand for supplying ships' bunkers with coal. In addition there was the increased use of fuel oil." He added, however, that owing to large orders received from San Francisco and elsewhere during August and September of 1914, the company in those months earned net profits of $46,000 and $54 000 respectively, but in October and November following the net profits were only $1,300 and $1,100. He said, further: "But I think the August and September results show that, given even a moderately good market for the coal, the company's mines are capable of earning very substantial profits, and that the money put into the property has not been wasted. And, I believe, the market is bound to come sooner or later. The war will not last for ever, nor will the depression of trade. The Pacific coast will begin to grow again in population and industry." Replying to a question regarding the serious shrinkage in the profits between the time the mines were worked by the Dunsmuir interests and the date of the statement of accounts presented, Mr. Fleming said that the operating earnings in the year ended June 30, 1911, were $665,000 from the mines, or $728,000 from all sources; in the next year they were $546,000 from the mines, or $751,000 from all sources. Then in the next year there was the strike, which practically stopped operations at the mines for a short time and made it difficult to produce coal. In regard to the money subscribed, $3,500,000 of this had gone into improvements to the mines and property generally. A very considerable amount of the money subscribed had to be taken as working capital, owing to the Dunsmuirs not having delivered to the company all the assets that were expected would be received,

but a decision as to these was now being obtained from the Privy Council of Great Britain. No directors of the company receive any salary, except two local directors, who are each paid $500. Many other questions were answered and then the resolutions submitted were adopted, as already stated.

The following notes relative to the property of the Canadian Collieries (Dunsmuir), Limited, on Vancouver island, British Columbia, may be of interest:

About the middle of 1910 those who organized the company acquired from the Wellington Colliery Co. the mines, coal lands, coke ovens, shipping docks and bunkers and other property connected with the carrying on of the coal mining and shipping business of Hon. James Dunsmuir and his associates, who had operated under the name of the Wellington Colliery Co. There are two collieries, each with its own separate shipping dock and appliances, railway between mines and dock, etc.

The Union colliery, near Cumberland, about 65 miles north of Nanaimo, in Comox district, is the more important of the two collieries. In 1910 there were operated Nos. 4 and 7 slopes and Nos. 5 and 6 shafts. In 1911 important changes were inaugurated, these including commencing to develop a hydro-electric power, so as to substitute electricity for steam at the several mines, the construction of a new tipple at No. 7 mine, relaying the track of the 12-mile standard gauge railway from the mines to Union bay with 80 lb. steel, and the substitution of 50 ton for 25 ton cars for conveyance of coal to the shipping bunkers, and sinking a new shaft (No. 8) at a place about one mile north of No. 7 mine. These several improvements were well advanced in 1912, but in September of that year labor troubles were experienced. Construction work was continued in 1913, the hydro-electric power system was completed and electric power replaced steam at all but No. 6 of the company's mines in the Comox field, all the mechanical shops and the coal washing plant at Union bay were also supplied with electric power and light, the development of No. 8 mine was continued, and the railway extended to it, while a small town of miners' cottages was constructed near the mine, and generally preparations were made for considerably increasing the output of the mines as soon as there should be the requisite demand for the coal. Meanwhile, production of coal was continued notwithstanding the continued opposition of the United Mine Workers of America. In 1914 the extensive scheme of development and improvement and extension of mining, handling and transportation facilities was practically completed, while the strike was "called of," all the workmen required having been available.

The Extension colliery, situated less than 10 miles southwest of Nanaimo, comprises Nos. 1, 2 and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 4 mine, worked by a shaft. About the middle of September, 1912, a strike of the miners necessitated the closing of these mines. The following spring work was resumed with fewer miners than formerly; later the strikers burned the surface buildings and destroyed the electric locomotives and the coal cars, so production of coal was stopped for a while. In 1914 work was being continued, and conditions were gradually improved until things were back to normal.

The shipping dock and bunkers for the Extension mines are at Ladysmith, with which there is standard-gauge railway connection, as well as with the railway between Victoria and Nanaimo.

The company's beehive-type coke ovens are at Union bay, but no coke has been made there since 1910. Last year there were negotiations with the object of resuming coke-making, to supply coke to a coast copper smeltery, but these were not successfully concluded.

The following table will serve to show what the output of coal has been for the last five years, and the number of employees for four years:

		No. of Employees		
Year.	Coal mined long tons.	Under-ground.	Above-ground.	Total.
Comox Colliery—				
1910	518,426	1,172	416	1,588
1911	437,335	996	263	1.259
1912	475,803	766	217	983
1913	508,095	786	223	1,009
1914 (estimated)	403,980	Not yet published.		
Extension Colliery—				
1910	390,482	737	194	931
1911	331,576	714	167	881
1912	265,766	698	164	862
1913	57,855	135	64	199
1914 (estimated)	129,934	Not yet published.		

The mines at both collieries were in condition for a much larger production than was made, and there were more miners obtainable than work could be found for, but the demand for coal was insufficient to admit of either colliery working anything like full time.

THE CONDENSATION OF GASOLINE FROM NATURAL GAS.

The condensation of gasoline from natural gas is the title of Bulletin 88, just issued by the Bureau of Mines, George A. Burrell, Frank M. Seibert and G. G. Oberfell, authors.

This report treats of a method of preventing some of the waste of the natural gas incidental to oil mining. This method, the condensation of gasoline from natural gas, offers to the oil operator and others a profitable means of utilizing some of the oil-well gas now being wasted. The most desired constituent of crude oil is obtained, the production of oil is not hindered, and the gas, after the extraction of gasoline, can be returned to the leased area to drive pumps or into pipe lines for uses to which natural gas is ordinarily put, generally with its fuel value lessened only in a slight degree.

The authors say: "Gas may be found in a sand and separate from oil. It may be found in more than one sand separate from the oil, or the gas sand may be just above and in contact with the oil sand. A given sand may produce oil and gas in one place and in another part of a territory gas only.

"Gas may come from the same sand as the oil itself. It is this manner of occurrence of gas and oil that the authors desire to emphasize, for under these conditions the gas is frequently mixed with enough of the gasoline constituents of the oil to warrant the erection of a plant for the purpose of condensing the gasoline.

"The gas usually finds its way to the atmosphere through the space between the casing of the well and the tubing inserted for the removal of the oil. This gas is the so-called 'casing head gas.' At the beginning of an oil flow, when the flow is natural, a large quantity of gas escapes to the air through the same tubing as the oil. Where the gas finds its exit to the atmosphere apart from the oil at the casing head, it is a simple matter to make pipe connections between the casing head and any desired point where the gas is to be utilized. This is frequently done when the supply of

casing-head gas is sufficient to warrant its utilization, but frequently, when the supply exceeds the small demands of the lease, the excess is wasted.

"When a well is first drilled, the quantity of gas escaping with the oil from the tubing is frequently enormous, being 10,000,000 to 15,000,000 ft. or more at times. This gas is wasted; the flow in time diminishes.

"When gas comes with the oil in the flow pipe, the two are often separated by means of a gas trap. The oil, entering the top of a drum, settles to the bottom and is withdrawn, and the gas flows off at the top. Many of the plants in California utilize gas that flows with the oil for condensing gasoline. One gasoline plant in the Cushing field, Oklahoma, also uses trap gas. A new type of trap for saving gas from gushers and separating the gasoline is described in this report.

"Oil wells that have passed the flowing stage and are being pumped may still continue to give off much gas at the casing head. The quantity may vary from little or nothing at some wells to 500,000 cubic ft. or more at others. When enough of the gas is available, it is used for pumping on the lease, the excess being wasted. A steam pumping engine of 50 horse-power requires about 25,000 cubic feet of gas for 10 hours' operation. From 12 to 15 cubic feet of natural gas is needed per horse-power hour for gas engines that are used on leases for pumping oil wells. If there is not enough of the gas available for working pumps, it is all allowed to go to waste, or perhaps some is used for heating and lighting a few scattered houses on the lease.

"The efficient utilization of the wasting casing-head gas ordinarily is a difficult problem. The many miles of pipe that would have to be laid to transport it from a field would usually be an unwarranted expense. However, some towns, among which may be mentioned Warren, Pa., and Sistersville, W. Va., are lighted and heated largely with casing-head gas.

"In general, however, the oil man considers casing-head gas as waste gas and its escape necessary in oil-well operations, to permit the maximum flow of oil into the well from the surrounding strata."

The bulletin also treats of the effect of drilling neighboring wells; the effect of formation of waxy sediment; the history of the making of gasoline from natural gas; the chemistry of natural gas, and many other matters of interest along these lines.

NICKEL ALLOYS.

In a paper presented at the Annual General Meeting of the Institute of Metals, London, March 19, 1915, A. A. Read and R. H. Greaves gave the results of a careful study of nickel-aluminium and copper-nickel-aluminum alloys.

Nickel-Aluminium—The influence of nickel on aluminium bears considerable resemblance to that of copper, in that it increases the yield point and tensile strength with the simultaneous diminution of elongation and reduction of area. It increases specific gravity, hardness and rate of corrosion in both fresh and sea-water, and decreases electrical conductivity and resistance to alternating stress. The present work dealing with alloys containing up to 5½ per cent. of nickel provides data for the following comparison between the effects of nickel and of copper on aluminium.

The effect on the microstructure is similar.

Specific gravities are equal for the same amounts of copper or nickel.

Increases in the yield point and tensile strength of rolled rods due to nickel is not so great as that produced by an equal quantity of copper, though the elongations are the same in both cases.

In the case of chill castings, the elongation of the nickel alloy is higher than that of the corresponding copper alloy, while there is practically no difference in tensile strength.

Malleability (hot and cold) is reduced more by copper than by nickel.

Ductility as measured by wire drawing is less for nickel-aluminium than for the alloy with an equal amount of copper.

Nickel-aluminium alloys have a high resistance to alternating stress.

In the case both of nickel and of copper alloys, the quenched material is almost identical in properties with the annealed.

The mechanical properties of copper-aluminium alloys reach a maximum at about 4 per cent. of copper. A similar maximum had not been reached at 5½ per cent. of nickel.

Corrosion of nickel-aluminium alloys both in fresh and sea-water is less than that of copper-aluminium alloys.

Copper-Nickel-Aluminium—The presence of copper and nickel together in aluminium leads to the formation of a triple eutectic, and the resulting alloys bear some resemblance to copper-aluminium alloys whose percentage of copper is equal to the total percentage of copper and nickel. None of the ternary alloys examined in the form of rolled rods showed as high a tensile strength as the 4 per cent. copper-aluminium, while in the cast state, the replacement of more than 2 per cent. of nickel by copper is of no advantage. This proportion of copper also gives the best elongation in chill castings. As in the case of nickel-aluminium alloys, the quenched material shows the same properties as the annealed. For any series of alloys in which the proportions of nickel and copper vary while their total percentage remains the same the specific gravities are constant:

The more malleable alloys are those in which nickel predominates, the binary nickel-aluminium alloys being the most malleable.

The more ductile alloys are those in which copper predominates, the binary copper-aluminium alloy being the most ductile.

The alongation of the hot rolled material is independent of the relative proportion of copper and nickel.

The corrosion is least when only nickel is present and greatest for the ternary alloys. In all cases, the corrosion is more marked as the total percentage of copper and nickel increases.

The behaviour of the material in the tensil tests was carefully followed up to a stress beyond the yield point: and various methods of defining the position of this point in these light alloys is discussed.

Among many other instances of the practical helpfulness of the mining fraternity in Canada is that of miners employed at the No. 1 mine, Ainsworth, British Columbia. About thirty of the mine staff and working force, together contributed $100 last month, this amount to provide two beds at the Cliveden hospital for wounded Canadians in England. The donation is the more worthy of mention for the reason that only a few weeks ago work was resumed at the mine after three months' inactivity.

GASOLINE FROM "SYNTHETIC" CRUDE OIL*

By Walter O. Snelling.

In the course of some experiments more than five years ago, made for a totally different purpose than the investigation of the oil used, I placed a small quantity of a transparent yellow lubricating oil in a bomb-like vessel and heated it to a relatively high temperature. At the end of the experiment I removed the oil from the vessel and was amazed to find that instead of bearing any resemblance to the oil which I had put in, it now had the appearance of ordinary crude oil. The green color by reflected light and the rich red-brown by transmitted light were so unmistakable as to at once lead to further investigation. I subjected the material to fractional distillation, and the surprise which I experienced at the appearance of the oil, changed to amazement when I found that it yielded, on distillation, 15 per cent. of gasoline and 30 per cent. of burning oil, and that its constitution resembled crude oil quite as much as did its appearance. Further, the gasoline and kerosene distillates which it yielded were of a clear water-white color, entirely without treatment with acid or alkali, and were entirely free from the odor familiar in "cracked" petroleum distillates.

The result of this experiment was quite too remarkable to be credited without further confirmation, and I at once filled the vessel with some of the same oil that I had used before, and again heated to about the same temperature that I had previously used, and for the same period of time. Upon opening the vessel and removing the contents I found, not the material resembling crude oil that I had obtained before, but apparently only the same oil that I had put in, somewhat darkened in color, but nevertheless far different in appearance from the material obtained in the previous experiment.

Evidently some condition existed in the first experiment that had not existed in the second test, and here began a series of tests in which I sought by the change of one variable after another to arrive at the identical conditions which must have existed in the first experiment. Only the fact that the bottle of heavy oil used in the first test was still in its place, and the further fact that I had no crude oil among the materials at hand when I began the experiment—only these facts kept me from believing that I had indeed made some mistake, and that crude oil had in some manner found access to my apparatus.

After many fruitless experiments I learned a fact which should have been obvious to me from the first, but which, in the surprise due to the unlooked-for result obtained, had quite passed out of my mind. In my first test, the vessel which I used had contained but a little oil (about one-fourth of the volume of the vessel only), and in all of the other experiments I had filled the vessel three-fourths full or more, in the effort to obtain as much of a yield as possible.

I repeated the first experiment, using the vessel but one-fourth full, and heating to about the same temperature, and for the same time as I had done in the other experiments. The result was once more the greenish liquid so familiar to anyone who has lived in the oil field, and its fractionation again gave 15 per cent. of gasoline, 30 per cent. of burning oil, etc.

Apparently some remarkable change must come about in the hydrocarbon molecules, when a hydrocarbon body is heated in a still approximately only one-fourth full of oil, that does not occur when the same hydrocarbon is heated under similar conditions, except that a greater proportion of the volume of the still or retort is filled with oil. With grave doubts and fears, I placed in my retort some kerosene. If this water-white material, after treatment, should come out green in color by reflected light, and red by transmitted light, then indeed I would be convinced that I was dealing with a true transformation into crude oil. The experiment ended, I poured out from the vessel a liquid which resembled Pennsylvania crude oil so perfectly that when I placed a bottle of the new product by the side of a bottle of the real crude, it was hardly possible to say which was which, by appearance alone. I next melted some paraffin and placed it in the vessel, and after heating under the prescribed conditions, I poured out a thin fluid, suggesting crude oil in every way, and which on distillation gave somewhat over 15 per cent. of a water-white gasoline, free from "cracked" odor, and other distillates in about the same relationship as in ordinary crude oil.

One after another I tried putting all natural hydrocarbons available to me through this process. Vaseline, rod wax gas oil, fuel oil, and B. S.—all these went into my treating vessel, one after the other. They all yielded materials similar in appearance, odor and composition. From any of these materials I obtained a synthetic crude oil containing about 15 per cent. of gasoline, and other distillates in about the same order as are found in typical crude oils.

After many experiments had shown me the exact conditions of temperature, pressure, and filling volume of my treating vessel which were necessary to success, I fondly imagined that my troubles were over. I did not for a moment think that human nature would involve greater difficulties than had even the control of natural conditions. Full of enthusiasm, I described the results of my experiments to an oil man, without of course describing the exact process, on which I had not yet applied for patent. He listened to me carefully and kindly, but his look of utter unbelief and incredulity was a trifle galling, to one whose life work had been devoted to scientific investigations. Had I been a promoter, selling stock in a gold mine located at Hackensack, or in a diamond mine on the outskirts of Brooklyn, I could hardly have met with less encouragement, or more entire disbelief.

To-day, when processes for increasing the yield of gasoline are being worked on by many investigators and when such lines of work are being encouraged and lavishly supported by a number of oil companies, and are being paid for in many cases with sums far greater than any probable returns, it may be hard for you to realize that only five years ago the shortest cut to suspicion and doubt, from your friends in the oil business, was even to suggest gently in ordinary conversation that perhaps by some method it might be possible to increase materially the ordinary yield of high-grade gasoline from crude oil. I tried it a few times, picking out the most kindly and genial of my friends in the oil-refining line. They would look, first pityingly and then suspiciously, and would say: "But after you have gotten out the gasoline that is present in crude oil, how do you think that you are going to get any more? Don't you

*Extracts from a paper presented informally at the New York meeting Feb. 1915 of the American Institute of Mining Engineers.

understand that when you have gotten it all out why you have gotten it all? What is left is kerosene, gas oil, or what-not. But it is not gasoline."

Only once did I venture mildly to protest. I suggested that possibly, since hydrocarbons were all compounds of hydrogen and carbon, it might be possible to rearrange the atoms in the molecule so as to obtain more gasoline. This view met with some recognition, and I was told that what I was talking about was called "cracking" and that it was thoroughly understood by oil men, and that, furthermore, "there was nothing in it" as far as making anything saleable as gasoline, as the product would invariably be of bad color, and of an extremely offensive odor.

Slowly I came to realize that the oil industry was not yet ready for any new views as wholly different from the preconceived ideas as these experiments made necessary. So I would go back, for comfort, to the water-white gasoline of 70° Be. which I had made from paraffin and from kerosene, from gas oil and from fuel oil and from rod wax, and patiently wait for the day when my friends in the oil business would realize that there were a few insignificant things about oil which they did not yet know. For their attitude I could hardly blame them, after all, when I remembered my own doubt when I had seen the results of my first experiments. They had not seen them, and therefore if they doubted, I could at least understand their position, and I am hardly prepared to say that I should have been less doubting than they were, had the positions been reversed.

This paper makes public for the first time the results of my experiments, and in presenting it I wish to express my indebtedness to John T. Milliken, of St. Louis, Mo., President of the Milliken Refining Co. He was the first oil man whom I met who was willing to believe that research could really add materially to the oil man's knowledge. He has generously supported the experiments which I am now reporting, and has supplied the financial help which alone has made this paper possible to-day.

Very careful studies made in my laboratory have now proved that when a hydrocarbon body such as gas oil, for example, is heated in a vessel which is filled to more than one-tenth of its volume with such oil, but such filling is less than one-half of the total volume of such vessel and if then the vessel is so heated that a pressure of say 800 lb. per square inch exists within the vessel, a very remarkable and fundamental change occurs in the hydrocarbon filling such vessel. It is as though the carbon and hydrogen atoms were free to rearrange themselves, and that such rearrangement goes on until a more or less definite mixture of hydrocarbons remains in the vessel. When the vessel is less than one-tenth filled with oil considerable "cracking" seems to take place and the product is quite inferior. When the vessel is much more than one-half filled with oil the reaction seems to fail almost wholly, the amount of light products produced being very small. But when the conditions within the vessel, as to amount of filling, and temperature applied, are as indicated above, the carbon and hydrogen atoms of the hydrocarbon seem to rearrange themselves to form crude oil and natural gas.

In this rearrangement, not only are low-boiling compounds produced from those of higher boiling point, but even the reverse action takes place. In several tests I have obtained from petroleum products of medium boiling point synthetic crude oils which contained high-boiling ends, whose boiling point was considerably higher than that of any of the constituents present in the original oil used. Apparently the entire process depends upon certain equilibrium reactions, in which constituents of different boiling point tend to be present in a certain very definite ratio, provided the space relationship within the treating vessel is of the proper order. Solid paraffin of course contains no constituents that are liquid or gaseous at ordinary temperatures, but upon treatment by this process even this solid paraffin is resolved into synthetic crude oil and natural gas, and the percentage of products of each definite boiling point appear to be in a definite condition of equilibrium. If instead of starting with paraffin we go to the other extreme, and start with kerosene which is entirely free from heavy ends, we will obtain a synthetic crude oil which is much lighter in gravity than that produced from paraffin, but which nevertheless contains high-boiling constituents whose boiling point exceeds by many degrees the boiling point of the heaviest product present in the untreated kerosene. Thus it will be seen that while this process is primarily one in which heavy hydrocarbons give crude oils containing light distillates (this being the main trend of the reaction), yet the process is so essentially one dependent upon equilibrium that if high-boiling constituents are absent, or present in very small amount, the equilibrium will not be satisfied until additional amounts of these high-boiling constituents have been produced as the result of the reaction which is going on.

A residual pressure, after cooling, always exists, due to the natural gas formed in the process, and the amount of this natural gas, like the amount of gasoline in the synthetic crude oil, seems to be very constant no matter what hydrocarbon is taken. It is of course evident to the chemist that natural gas and gasoline contain a greater percentage of hydrogen than do heavier oils, and it is very interesting to note that when the charge which is placed within my treating vessel contains a hydrocarbon deficient in hydrogen, the formation of saturated gasoline goes on just the same, and the synthetic crude oil produced carries a "mud" consisting of the carbon which in the rearrangement has failed to find hydrogen. The gasoline produced from materials even highly deficient in hydrogen is quite normal in color, and does not appear to be in any way like the "cracked" products which are produced by the thermolysis of oil vapors, etc.

It is of course evident that if putting any hydrocarbon through the process described makes it into a crude oil, it ought to be possible to take any hydrocarbon and first convert it into crude oil by the process described, then remove the gasoline, for example, or any other constituent, from this crude oil by distillation, and then to subject the residue to a repetition of the process. I have done this many times, and have converted paraffin and other petroleum products almost wholly into gasoline and natural gas. I have obtained from paraffin about 70 per cent. of water-white gasoline, the remaining 30 per cent. representing the natural gas formed by the repeated action of the process, and some free carbon. From fuel oil, gas oil, vaseline, and similar materials, I have obtained from 50 to 70 per cent. of water-white gasoline, and samples of this gasoline, even after standing for a year or two, do not discolor, nor acquire an offensive or "cracked" odor. I wish to particularly note that this gasoline, even when produced, was not treated in any way, and has never come in contact with either acid, alkali, fuller's earth, bone black, or other related materials. In brief, the process which I have described produced, from practically any hydrocarbon, a material which resembles natural crude oil, and which gives a gasoline which appears equal in

quality and appearance to gasoline produced from natural crude. Both the crude oil produced by my process and the gasoline produced from its distillation possess an odor which is somewhat different from the odor of natural crude oil and ordinary gasoline. This odor, while peculiar and distinctive, is not in the slightest like the odor of "cracked" products, and it is in fact a slightly milder and sweeter odor than that of ordinary oil products. Upon mixing my synthetic crude oil, or the gasoline produced from it, with certain muds and clays, it seems to be altered, and the odor changes and becomes much more like that due to ordinary crude oil. Personally I am of the belief that crude oil in nature has in some cases been produced by some process related to that which I have here described, the effect of the high temperature which I use for a short time having in earth history been produced by very much lower temperatures acting through geological ages. I believe the condition which in my retort is represented by about three-fourths open space, in nature has had its equivalent in the open space in the sand or other porous rock which has been the repository of the oil, and I believe that natural gas, which is so commonly associated with petroleum deposits, has had a related origin in nature to that which it has in the process worked out in my laboratory experiments.

The study of the genesis of petroleum is so involved that I do not wish these suggestions to be taken in any way as other than ideas which have forced themselves on my mind after noting the very considerable similarity in appearance and constitution which exists in most of the petroleums of the world (except where a porous cover or other well-recognized conditions have allowed the more volatile materials to vaporize, or well known oxidation or other phenomenon to take place), and it seems more than likely to me that any process which in the laboratory will produce materials of such similar appearance and composition from raw products of the most diverse nature, must surely have some connection with the conditions which in geological time have similarly produced, from starting out products of many different kinds, a material possessing such well-marked and easily recognized characteristics as petroleum.

These experiments which I have described have been wholly of a laboratory nature, and much work remains to be done in the application of the principles which have been discovered to commercial work on a large scale. While it may seem to many that the pressures and temperatures employed are so high as to preclude the possibilities of commercial work, yet I do not think that is the case. Processes have been developed abroad, during the past few years, in which ammonia is made synthetically by reactions requiring both higher pressures and higher temperatures than those which are made use of in my present work. As these ammonia researches have gone on from their laboratory inception to their commercial development upon a very extensive and successful scale, I believe the present process will find similar development comparatively easy. The conditions necessary for successful commercial work are already well known, and involve no engineering features which American ingenuity cannot easily provide, and it is my hope that this process will be soon developed to the point where it will fulfill commercially the remarkable promise that it now seems to offer.

C. & H. DECLARES $15 DIVIDEND.

The quarterly dividend rate of the Calumet and Hecla Mining Co. was increased recently from $5 to $15 a share, the largest quarterly disbursement since 1913.

THE GERMAN PIRATES

As Americans See Them.

New York Times editorially says: From our department of state there must go to the imperial government at Berlin a demand that the Germans shall no longer make war like savages drunk with blood, that they shall cease to seek the attainment of their ends by the assassination of non-combatants and neutrals. In the history of wars there is no single deed comparable in its inhumanity and its horror to the destruction, without warning, by German torpedoes of the great steamship Lusitania, with more than 1,800 souls on board, and among them more than 100 Americans. Our demand must be made, and it will be heeded, unless Germany in her madness would have it understood that she is at war with the whole civilized world. We have learned much about Germany since the war began, much that has shocked the world's sense of humanity, but this frightful deed was held to be within the domain of the incredible until it was perpetrated. It transcends in atrocity anything our government could have apprehended at the time it issued its warning.

Now, as a necessary sequence of our note of Feb. 10, there must be a further communication to the German government, and it must be something more than a protest. We must demand that Germany shall not continue to make war on us. We may present the demand with reasonable confidence that Germany will pay heed to it. The Germans cannot advance their cause by forcing the world to perceive and admit that they are a people apart, that they are bent upon making war by methods and practices which civilized nations have long since renounced and condemned, and by exhibiting a degree of brutality which is commonly associated with madness. It is not to be believed that either the German government or the German people are wholly mad, and the notice we are compelled to take of the destruction of the Lusitania will, we hope, serve to recall them to sense and reason.

The New York Herald says: Undoubtedly hundreds of Americans have been sent swirling to eternity by the German pirates.

Henceforth is international anarchy to be the controlling factor in marine warfare? Henceforth is piracy on the high seas to be recognized and go unprotested and unpunished? Henceforth is the wanton murder of neutrals and non-combatant passengers to be treated as regrettable incidents and go at that?

It is for the neutral countries, and above all for the United States, to answer these questions. It is a time of gravity in American history unmatched since the Civil War. This cold-blooded, premeditated outrage on colossal scale will cause such a blinding white light of indignation throughout the neutral portion of the world, unhappily growing smaller and smaller, that there cannot conceivably be in Washington any thought of turning back from the note to Germany sent Feb. 10.

The Boston Post says editorially: The sinking of the British liner Lusitania by the torpedo of a German submarine yesterday, with terrible loss of life, is the worst crime against civilization and humanity that the modern world has ever known. It is a reversion to barbarism that will set the whole world, save perhaps the little world of its perpetrators, aflame with horror and indignation.

If she (Germany) wished to set every country on earth, save her Teutonic-Hungarian ally, against her,

she could have taken no better means. If she desires to be a hissing in the mouths of self-respecting nations, she is triumphant in her shame.

The Germans will cry, of course, that they had warned Americans not to sail on the Lusitania. That warning was in itself an insolent striking at Great Britain over the head of the government of the United States. It was as inadequate as it was impudent, and was not in any sense a substitute for the warning at the time of attack, which respectable warfare—and there can be such—has hitherto granted to noncombatants on the sea. The court of human opinion will find no palliation for this indefensible outrage.

The New York World says editorially: The circumstances and the consequences of the destruction of the Lusitania by a German submarine call for all the self-restraint and self-possession that the American people can command.

Morally, the sinking of the Lusitania was no worse than the sinking of the Falaba.

The whole German submarine policy in its campaign, not against British ships of war, but against merchantmen on the high seas, is a revival of piracy—piracy organized, systematized and nationalized. It is piracy against neutrals as well as against enemies. One day it is a British passenger ship that is torpedoed. Another day it is an American merchant ship flying the American flag which is destroyed without a word of warning. And still another day it is a defenceless Swedish or a Norwegian or a Dutch ship that is blown from the face of the waters by a German torpedo.

Modern history affords no other such example of a great nation running amuck and calling it military necessity.

The New York Tribune says editorially: No voice will be raised, no effort will be made, to force the hand, to hasten the action, of the President of the United States. But neither he nor any other official in our government can mistake the temper in which their fellow citizens will wait. They will wait with the casualty list in their hands. The nation which remembered the sailors of the Maine will not forget the civilians of the Lusitania.

The American says: The sinking of the Lusitania, with her heavy freightage of peaceful travelers, including hundreds of women and children was not an act of war; it was a deed of wholesale murder.

The Sun says: It is proper to keep clearly in mind the fact that the undersea attack on the Lusitania is of less importance to us as an event involving international relations than the recent sinking of the Falaba. That is, if it shall happily prove true, that all the American passengers who sailed a week ago to-day on the great Cunarder escaped with their lives. If, on the contrary, any American citizen died in consequence of the torpedoing of the Lusitania the incident is in the class with the Falaba, and technically possesses neither more nor less significance than that affair.

Yet, when all this has been said, the fact remains that no episode of the war has startled and aroused public opinion in this country in a greater degree. That it was premeditated we know, that it was reckless of innocent non-combatant lives we are sure and "dastardly" is the word on millions of American lips this morning.

The New York branch of the Jeffrey Manufacturing Co., has been moved from 77 Warren street to 50 Dey street, adjoining the Hudson Terminal.

PERSONAL AND GENERAL

Mr. W. M. Archibald, of Trail, B.C., one of the Consolidated Mining and Smelting Co.'s engineers, was in Spokane, Washington, last month.

Mr. J. W. Boyle, of Dawson, Yukon Territory, was in Victoria, B.C., in April, conferring with the military authorities there relative to the mounted gun section raised by him in the Yukon for service in the European war.

Mr. Ed. Dedolph, who was engaged in 1913 and 1914 in connection with the electric zinc smelting experiments carried on at McGill University, Montreal, and at Nelson, B.C., has arranged to open an assay office at Kaslo, B.C.

Mr. C. W. Drysdale, of the Geological Survey of Canada, is expected to spend the field-work season of 1915 in British Columbia, probably in the Lillooet district.

Mr. S. S. Fowler, of Riondel, Kootenay lake, B.C., general manager for the New Canadian Metal Co., visited Calgary, Alberta, last month.

Mr. Oscar Lachmund, general manager for the Upper Canada Corporation and the British Columbia Copper and New Dominion Copper Co.'s, has returned to Greenwood, B.C., from a business trip to New York City.

Mr. Douglas Lay, for several years superintendent of the Van-Roi silver-lead mine and concentrating mill in Slocan district, British Columbia, is on a visit to Walkerton, Ont.

Mr. Ralph C. Nowland, of San Francisco, Cal., field engineer for the exploration department of D. C. Jackling and associates, in the early part of April spent two or three days in Franklin camp, Boundary district of British Columbia, looking over mining properties there. He was accompanied by Mr. Fred M. Wells, of Vancouver, B.C.

Mr. Noble W. Pirrie, assayer, of Vancouver, B.C., left that city on April 23 to take up a commission as a lieutenant of artillery, for active service in Europe.

Mr. Alexander Sharp, of Vancouver, B.C., mining engineer to Mr. P. Burns and associates, was recently in Spokane and other places in northeastern Washington, on mining business.

Capt. B. Tamblyn, who was in Nelson district, British Columbia, early in April, has been investigating mining conditions and properties in that part of West Kootenay.

Mr. Gwynn G. Gibbins, of the Huronia Belt Co. staff, sailed on the Adriatic to join the Royal Engineers.

Mr. G. B. Wilson, manager for the company owning the marble quarries at Marblehead, north of Kootenay lake, B.C., has returned to the quarries from a business visit to the United States.

Col. A. M. Hay has been elected president of McIntyre Porcupine Mines, Ltd. Other newly elected directors of McIntyre are Sir Henry Pellatt, W. J. Sheppard, J. B. Tudhope, J. P. Bickell and J. R. Muerling.

Thomas Cantley, vice-president and general manager of Nova Scotia Steel, is on his way to Petrograd on business for the company.

Mr. C. A. Foster has returned to Haileybury from London.

Mr. Geo. R. Rogers, of Toronto, is at Gowganda.

OBITUARY

Henry Edward Croasdaile, who died at his ranch, Crawford bay, an arm of Kootenay lake, British Columbia, on April 14, was well known in the Kootenay district, he having been for some years actively engaged in developing the Silver King mine, on Toad mountain, a few miles south of the city of Nelson. The Nelson "Daily News" states that he was of Irish parentage, and was in his sixty-ninth year when he died. He was an ex-lieutenant of the Royal Navy; for some years was engaged in ranching in the far western States; later he was a stockbroker in Victoria, whence he went to Nelson in 1893. Immediately after his arrival in the chief town of Kootenay he took an active part in its business affairs, and as the years passed he became prominent in the commercial, industrial, and social life of Nelson. In company with Messrs. Winslow Hall and John McDonald, Mr. Croasdaile went to London in 1894 and promoted the company which was, in 1895, organized as The Hall Mines, Ltd., to acquire and operate the Silver King group. An aerial tramway four and one-half miles in length with a difference of 4,500 ft. in altitude of terminals, was constructed from the mine down to the smeltery site at Nelson. The first furnace of the smeltery, with a capacity of 160 tons a day, was blown in during 1896. The following year a furnace having an average capacity of 240 tons a day was built, and a reverberatory plant was added. In 1900, more capital being required for projected extensive development operations, the company was reorganized as The Hall Mining and Smelting Co., Ltd. In 1902, the known orebodies in the Silver King mine having been exhausted, and the supply of copper ore consequently becoming very small, the larger furnace was adapted to the requirements of lead smelting, and thereafter the smelting done was chiefly of custom ores. Meanwhile Mr. Croasdaile had retired from the management of the company. Mr. Croasdaile was connected with other mining undertakings, among them those of the B. C. Exploration Co., of which he was general manager. For some years after his withdrawal from mine management Mr. Croasdaile was in England, where he carried on a brokerage business, which he continued after he returned to Nelson. Following the loss of his only son about four years ago, and of his wife two years later, Mr. Croasdaile went to live on his ranch at Crawford bay with his sister and daughter, both of whom survive him. His body was interred at Nelson on April 16.

Joseph Foy.—The body of the late Joseph Foy, mine manager for the Pacific Coast Coal Mines, Ltd., was recovered about the end of April, and was buried at Nanaimo, Vancouver island, B.C., on May 1. Deceased was one of nineteen men who were drowned when the company's Fiddick mine was flooded by the breaking through of water from an adjoining abandoned mine on February 9, last. Mr. Foy sacrificed his life by going down the slope and endeavoring to save some of the miners caught by the rush of water in the workings lower down. He was a native of Whitehaven, Cumberland, England, and was 48 years of age. On arriving in British Columbia six years ago, he entered the service of the Pacific Coast Coal Mines, Ltd., first having charge of the development of the company's new mine at Suquash, in the northern part of Vancouver island, and afterward as overman supervising the work of sinking the shafts at the company's Morden mine near South Wellington. In 1913 he became manager at the Fiddick mine at South Wellington. He leaves a widow and eight children.

SPECIAL CORRESPONDENCE

NOVA SCOTIA

The production of the Dominion Coal Company for the first four months of the year compares with 1914 approximately as follows:

	1914	1915
	Tons	Tons
Glace Bay mines	1,396,000	1,195,000
Springhill mines	133,000	134,000
	1,529,000	1,329,000

These figures show a decrease of approximately 200,000 tons, or less than half of one month's full output spread over four months. This is a fair showing in war time.

The first steamer for the St. Lawrence left on the 30th April. Last year the first steamer left Sydney for Montreal on the 25th April, but did not reach destination until the 5th of May, because of the unusually heavy ice conditions.

Prospects for the summer months are quite promising. Charter steamers will probably be slow in delivering because of the attractive freight rates now prevailing, and the general scarcity of suitable vessels caused by the requisitioning of ships by the Admiralty. It is expected that the level of last year's shipments will be maintained during the coming summer.

Stocks of coal at the mines are much smaller than they were last year. Some of the coal companies have not put any coal into banks during the past winter, and other companies have reduced the size of their banks. Requirements of coal for steel-making purposes will probably exceed the requirements of last summer, and so far as it is safe to forecast the future, indications are that the coal trade may experience a limited revival during the next six months.

The new benzol and toluol plant of the Dominion Steel Company is in operation, and a considerable quantity of benzol has already been made. Toluol is now being produced. It is understood the nitration of the toluol is to be undertaken by the Canadian Explosives Co. at their Ste. Anne plant. Officials of the Steel Company express themselves enthusiastically over the results of the benzol plant, which they claim has eclipsed the records of other plants in the United States.

Acadia Coal Co.—Success has attended the recovery operations at the Allan shaft of the Acadia Coal Co. The recovery operations were undertaken in a very deliberate manner, with much forethought and planning. It is understood that use was made of breathing apparatus, principally for advance work, and the construction of air stoppings. The work of the apparatus men was merely supplementary to the main recovery operations, of course, but has proved a useful example of the true function of these devices, and of what can be done when they are used with judgment and as part of a previously developed plan of operation.

Miners at the Front.—In common with practically all the coal mining districts in the Empire, the mining districts of Nova Scotia have contributed at least their full proportion of recruits to Britain's armies. Springhill, Nova Scotia, was always a live centre of military interest, and has for many years maintained an enthusiastic militia unit. The number of men who have gone from Springhill to the front has made an appreciable difference in the number of men available for work at the collieries. The Sydney coal field contributed very largely to the 17th Field Battery, which is now doing excellent work in France, and within the past few days a detachment of seventy recruits left the town of Glace Bay as a draft for the Second Contingent.

Practically the whole of these men were miners or in some way connected with the mining industry.

In a recent speech made by the Prime Minister of Great Britain at Newcastle-on-Tyne, Mr. Asquith stated that 217,000 miners had enlisted, "fifty per cent. of the miners of military age." This is a record of which the coal miner may well be proud. When the tale of this war comes to be written, it will be found that the miner has played his part well, which is exactly what those who know the miner in his daily walk and conversation would expect.

COBALT, GOWGANDA AND SOUTH LORRAIN

Since the war commenced there has been so little activity in the silver fields of Northern Ontario outside a radius of a few miles round Cobalt that it might almost be said that interest was dead apart from the working mines inside a very narrow circle. The exceptions are, of course, the Miller-Lake O'Brien at Gowganda, and the Casey to the north-east of New Liskeard.

The past month has seen more stir in the outer camps than for several years past.

Gowganda—Up the Montreal river the Miller-Lake O'Brien company has resumed operations on the usual scale after being obliged to seriously curtail production for some months owing to the dry summer, power being from hydro-electric installation. In addition a company has decided to commence preliminary operations on a group of claims known as the Homestead on Wigwam lake. There are quite good veins on the surface and it has been resolved that they shall have a chance. In Elk Lake two or three companies or syndicates are doing more or less desultory work on claims.

In South Lorrain it is reported that the Wettlaufer may start up again soon. The Currie is still being worked by the Pittsburg Lorrain and cross-cutting from the shaft on the Talon claims is continued. There is also a report that the old Bellellen may be opened up again.

Casey.—The most important and definite step to develop new territory will be made through the Casey Seneca company which has taken over the Murray claims. This property corners the old mine workings of the Casey, and is directly south of the new shaft where such good results have recently been obtained. The difficulty with the development of claims in this vicinity is that there is such a very heavy clay overburden. But now that the Casey is finding such good ore near the Murray line the chances in sinking a shaft blindly in the clay are less than when there was no development within two claims.

An option on a block of stock of the new company has been taken by Messrs. Harry Worth, president of the Seneca Superior Silver Mines, and R. F. Segsworth, treasurer of the same company. The new claim is guaranteed vigorous and effective prospecting and the results to this section of the Cobalt field may easily be of some importance. In the same section the Casey Mountain mining company has also resumed work with a small gang of men. It is known that there is a large conglomerate area here, but it could never be prospected by reason of the lack of outcrops and the very heavy overburdens.

Silver Leaf.—Excellent results have been obtained on the Silver Leaf in the winze 40 feet below the 75-ft. level. The winze was put down on ore. About 30 ft. down the ore became lean and a drift was run at 40 ft. Another vein about an inch wide of good ore soon came into the face and this was followed. In a few rounds there also appeared in a corner of the drift the best vein that has been found on the Leaf since it came under the lease of the Crown Reserve mining company. All the ore is being dumped down to the 200-ft. level of the Silver Leaf and trammed through the Crown Reserve rock house. High grade is sacked here. Low grade goes over the aerial tramway to the Dominion Reduction company. This will probably be altered if good developments continue, and a new shaft will be sunk on the Silver Leaf to facilitate the transportation of ore.

The Right of Way is being operated again. So far operations have been quite successful. Before power was available some hand steel work was carried out which put in sight some high grade ore, and already between six and eight tons have been sacked. In addition a contract has been made with the Northern Customs concentrator to send 30 tons a day for treatment. It is understood that the grade of milling ore being treated is quite satisfactory. In addition a new vein of high grade has been discovered in one of the walls of the old workings.

The Princess mine is under lease to Mr. Sidney Smith of Haileybury, who has commenced work with one drill on the 55-ft. level. The lease is on a royalty basis. The La Rose company shut down the Princess some months ago, it being understood that not enough ore was in sight to warrant further work except on a very restricted scale.

La Rose—A good grade of milling ore is being treated at the Northern Customs concentrator from the University mine. This ore is being taken from a point near the old workings. The La Rose is conducting quite extensive development work at this old mine.

Cobalt Lake is rapidly being drained, it being estimated, that it is going down at the rate of a foot a day. The lake had an average depth of 40 ft. last fall before the rock cut at the end of the lake lowered it six feet. It was estimated to contain 300 million gallons of water. The discharge pipe is running at about half bore into Mill creek.

King Edward—Work has started on the old King Edward under the direction of the York Ontario mining company.

Casey-Cobalt.—Very good results have recently been obtained at the Casey Cobalt mine from the new shaft on the east claim. It is understood that three veins, small, but of good grade ore, have been cut and are now being drifted upon.

The O'Brien mine development in the diabase is exciting much interest in the Cobalt camp. During last year, of the 1,200,000 ozs. produced two thirds came from the diabase. No. 6 shaft, which is in the diabase, is 300 ft. deep, and a winze has been sunk another 200 ft., about 1,000 ft. south and east from the shaft. As shoots of high grade ore are found, the better grade is handpicked out and the remainder is taken to the mill in electric locomotives on the surface. The heads at the mill from the diabase ore exclusive of the high grade ore run about twenty ounces. The coarse metallics are taken out of the ore by metallic traps at the end of the tube mills before the product goes to the cyanide tanks.

KIRKLAND LAKE AND PORCUPINE

Sesikinika—Good reports are beginning to come in from prospectors working claims in various portions of the gold belt near the height of land. Near Sesikinika lake some small veins of quartz rich in gold have been uncovered on the Hughes properties adjoining the townsite. These quartz veins are distributed over an area of four feet and the orebody has been traced for 500 ft. Some test pits are now being put down on them.

In Deloro township some discovery of good ore has been made on the Pike Lake company claims, and this is encouraging further prospecting of claims in this section of the Porcupine field.

The Dome Lake mine and mill closed down at the end of the month. It is known that the interruption of operations is only temporary, but for some time past the results of the mill runs have not been more than paying running expenses. The directorate felt that it was necessary to make some readjustments before the property could be run at a profit, and in the meanwhile determined to close down the mine and mill.

McIntyre—A complete change of directorate was made at the annual meeting of the McIntyre whereby a majority of Canadians was elected to the board.

Tough Oakes—Development on the 300-ft. level of the Tough Oakes mine has been very satisfactory of late. The drift at this level has been pushed for 300 ft. and there is good ore in the face. The drift is now entirely in the red porphyry. Two-thirds of the ore going to the mill is coming from the dump and the other third from development work. The mill is making excellent practice although some mechanical adjustments will have to be made.

The Rea mine has closed down, with the exception of the completion of some diamond drilling on the 300-ft. level. During all the time the Mines Leasing company had this property they ran a ten stamp mill with such good results that they were enabled to pay a 5 per cent. dividend. All the ore in sight has now been mined out and development work not leading to the expectation that further ore would be found it has been determined to close down both mill and mine.

Several test pits have been put down from the surface on other veins on the Rea, but they failed to disclose anything of importance.

Vipond—As a means of exploration a diamond drill is being used on the Vipond at the 300-ft. level from the west face. The vein at this point has made a turn, and it is considered more economical to endeavor to locate the extension with the diamond drill than to follow it in the drift.

A winze is being sunk from the 300-ft. level to the 400-ft. The ball mill, which should have been delivered some time ago, has now been installed and will raise the capacity of the plant considerably.

Production at the Vipond for the first three months amounted to $77,000. The total costs are now running $5 a ton, leaving a handsome profit on operations.

The St. Paul claims in Bartlett township are being worked. A shaft is being sunk by the owners of the claims, it is stated with satisfactory results.

The Huronian Belt Co. has decided to start up the North Thompson again. A contract has been let for the sinking of a three compartment working shaft to a depth of 300 ft. The present shaft is down to the 100-ft. level, but considerable work has been prosecuted from this level.

BRITISH COLUMBIA

Placer Gold Mining.—As the time for a resumption of placer gold mining for the 1915 season is at hand, interest is taken in the outlook for a water supply for hydraulicking and other sluicing operations. In Cariboo district the snowfall was light last winter, so that hopes for a gravel washing season of average length are now based on the expectation of a rainy summer following a dry late winter and early spring season. No information is available concerning the winter's snowfall in the Atlin field or other parts of Cassiar district, but there is general confidence that if there be sufficient water to allow of operations being continued throughout the possible running time, say a season of 180 days, the output from Atlin streams will be larger in 1915 than during several years past.

"Mining and Scientific Press," San Francisco, recently published an interesting article giving much valuable detail relative to hydraulic mining in the Atlin field. The writer of the article, Mr. A. D. Hughes, says: "The information given covers the operations of the North Columbia Gold Mining Co. during four seasons, 1910-1913, both inclusive. The work was carried on under the management of Mr. J. M. Ruffner. I was present during the whole of this period, and during three years acted as superintendent. The data given are therefore authentic and represent the result of observations at all stages of the work and under all the conditions obtaining."

Only brief excerpts from Mr. Hughes' long account may here be made. First, as to the length of the working season, he says: "During the four years considered there was but little variation in the dates of starting preliminary work, namely April 18, or that for commencing sluicing, May 10, and closing down, November 10." After describing the water supply system, Mr. Hughes states that: "The work was conducted from two separate pits, one on the south side of Pine creek opposite the town of Discovery, and the other about half-a-mile up stream on the north side. The water for both pits was taken from the main ditch, which is on the south side. There was about five feet of water above the sill of the gates at Surprise lake (which has an area of about 18 square miles), and with the constant supply coming from tributary creeks a steady flow of about 10,000 miner's inches of water was reasonably certain." As to operations: "As soon as the weather conditions permitted, 20 men were started to work in No. 2 pit. Usually there was one of the main pipe-lines to be moved. This made a new pressure box or penstock necessary......At this plant the pressure boxes were built as close to the ditch as possible, usually about 30 ft. The flume was made 5 ft. wide and about 6 ft. deep. The pressure box dimensions were 8 x 16 ft. inside and 12 ft. deep. The sides of the box and flume were brought well above the water level of the ditch, so that they required less attention.........Two main pipe-lines were used, each about 1,500 ft. long, consisting of 30, 28 and 26-in. pipe to the main Y's at the pit. They consisted of 12 and 14-gauge slip-joint riveted pipe.......From the

main Y's the pipe was reduced to smaller sizes to run to the monitors. This pipe was of 14 and 16-gauge, mostly 16 and 18-in. diam. Eight monitors were in use five No. 6 machines, 15-in. intake and 6-in. nozzles, and three No. 5 machines, 11-in. intake and 5-in. nozzles. Each machine was equipped with a deflector, and each pipe-line with a gate. Nearly all the monitors were ball-bearing machines. Four machines were operated on each of the main lines." Concerning the gold recovered, Mr. Hughes says: "The gold was fairly coarse and was easily saved. Quicksilver was used in the riffles at all times. In cleaning up, about 75 per cent. of the gold was recovered in the first 35 ft. of the sluice. About 10 per cent. of the gold was recovered from the bedrock immediately around the head of the sluice; that is, within a radius of 40 ft. Tests proved that it did not pay to retard the work to clean the remainder of the bedrock by hand." The actual operating time is given as 154 days per season in Pit No. 1, with 4,500 miner's inches of water used per day, and 283,300 cu. yd. of gravel worked per season; average depth of ground 60 ft. 6 in.; average total cost per season, $34,192.30; average cost per cu. yd. 12.07c. The corresponding figures for Pit No. 2 are: Actual operating time 141 days per season; water used, 4,250 miner's inches per day; 178,580 cu. yd. of gravel worked per season; average depth of ground, 16 ft. 4 in.; average total cost per season, $35,743.46; average cost per cu. yd., 20.01c. No information is given as to the value of the gold recovered, but some idea is obtainable from figures given in the Annual Report of the Minister of Mines for 1912, in which Mr. Ruffner is quoted as having stated that the average recovery from 197,600 cu. yd. of gravel washed in Pit No. 2 during the 1912 season was 36.7c. a cu. yd. Allowing a similar average value for the four years under notice, the result would be an average recovery per season of $65,538 at a cost of $35,743. If a similar recovery per cu. yd. has been made in Pit No. 1, the result would be an average yearly recovery of $103,971 at a cost of $34,192. These figures, however, are merely surmises, not verified returns.

It is noteworthy that Mr. Hughes, resident in the district and presumably in a position to make a fair estimate, places the total value of the gold recovered yearly at $350,000 "during the time mentioned." If it be meant that during the four years under notice that was the average value per year, it is evident that the amounts on official record are very conservative, for they are shown in the Annual Reports as follows: For 1910, $275,000; for 1911, $225,000; for 1912, $290,000; for 1913, $315,000.

East Kootenay.

Sullivan Group.—Ore shipments from this lead-silver mine to the Consolidated Mining and Smelting Co.'s smelting works at Trail continue to be made on a much larger scale than at the corresponding period of 1914. For the first sixteen weeks, to April 22 inclusive, of the current year the total quantity of ore received at Trail from this mine was 13,099 tons. That for the corresponding period of 1914 was 5,287 tons, with 238 tons from the St. Eugene, also situated in Fort Steele mining division of East Kootenay, but not on this year's shipping list.

Placer gold mining will soon be again under way on several gold-bearing streams in Fort Steele division—on Wild Horse and Perry creeks in particular. While the yearly output of placer-gold is not large, there are still a few men who engage in placer-mining in this division every year. There is little new to chronicle relative to coal mining, except that the Crow's Nest Pass Coal Co. is having a somewhat better demand for coke now that all the furnaces at the Granby Consolidated Co.'s copper smeltery at Grand Forks, Boundary district, are in blast once more.

West Kootenay.

Ainsworth.—Four mines shipped ore to Trail during recent weeks, namely the Early Bird, No. 1, Retallack & Co.'s Whitewater group, and Utica. Of the total for four weeks ended April 22, 380 tons, the No. 1 shipped 275 tons, and the others one car load each.

The annual general meeting of the Utica Mines, Ltd., was held at Kaslo, Kootenay lake, on April 15. From a published account of the meeting it is learned that Mr. Geo. H. Aylard, general manager for the Standard Silver-Lead Mining Co., was elected president, and Mr. Chas. F. Caldwell, of Kaslo, vice-president; the other directors are: Mr. J. D. Chalin, St. Catharines, Ontario; Mr. W. M. Archibald, of the mining engineering staff of the Consolidated Mining and Smelting Co., of Canada, Ltd., Trail; Mr. W. O. Miller, of Nelson, district divisional superintendent for the Canadian Pacific Railway Co., and Dr. Gilbert Hartin, also of Nelson. The "Kootenaian" states that: "The new directorate is regarded as a strong one. The report of operations for the past year showed that during the latter part of 1914, owing to war conditions and the low prices received for metals contained in ore shipped, no profit had been earned, but that during the first quarter of 1915 operations had been profitable......The company is now practically out of debt, having due from ore sold about sufficient money to offset current liabilities. The manager's report indicated that the mine is looking well, and the future is regarded by the directors as being promising."

Slocan.—Production of silver-lead ore in any considerable quantity has not yet been resumed judging by receipts at Trail from this division, the figures for four weeks having been as follows: From the Rambler-Cariboo mine, 198 tons; Hewitt-Lorna Doone, 46 tons, and Wonderful, 42 tons. However, zinc concentrate is being made at two mills, the Ivanhoe mill, near Sandon, running largely on ore from the Surprise mine, and the mill of the Silverton Mines, Ltd., treating Hewitt-Lorna Doone ore. It is reported that the Slocan Star mill will shortly be again operated, but no definite information has been made public relative to the Standard mill, at Silverton.

Several of the smaller mining properties in Slocan division are again being worked, so that the position is improving generally in this part of West Kootenay district.

A shipment of 6,000 tons of zinc ore from Australia to be smelted in the Southern Kansas and Oklahoma smelters has been passed through Kansas City custom house.

The big shipment from Australia comes as a result of the war in Europe which has closed most of the big European smelters.

The Broken Hill district in Australia, from which the shipment of 6,000 tons has come, produces about 400,000 tons of zinc a year. It has largely been shipped to Europe to be smelted. The 6,000-ton shipment of ore, it is expected, is the forerunner of other shipments to the smelters in the Kansas City district.

MARKETS

NEW YORK MARKETS.

May 7.—Connellsville coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.55 to $1.65 per ton.
- Foundry coke, prompt, $2.00 to $2.50 per ton.

May 7.—Tin straits, 39.25 cents.
- Copper, Prime Lake, 18.87½ to 19.12½ cents.
- Electrolytic copper, 18.62½ to 18.87½ cents.
- Copper wire, 20.00 cents.
- Lead, 4.20 cents.
- Spelter, 13.65 to 13.75 cents.
- Sheet zinc (f.o.b. smelter), 17.50 cents.
- Aluminum, 19.50 to 19.75 cents.
- Nickel, 42.00 to 45.00 cents.
- Platinum, soft, $40.00 per ounce.
- Platinum, hard, $42.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $74.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
April—		
24	50⅝	23⅞
26	50¾	23 15/16
27	50½	23 13/16
28	50⅝	23⅞
29	50⅝	23⅞
30	50½	23 13/16
May—		
1	50½	23 13/16
3	50¼	23 11/16
4	50⅛	23⅝
5	50	23 9/16
6	50	23 9/16
7	50	23½

TORONTO MARKETS.

May 7.—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 15½ cents per lb.
- Lead, 5½ cents per lb.
- Tin, 51 cents per lb.
- Antimony, 40 cents per lb.
- Copper, casting, 20½ cents per lb.
- Electrolytic, 21 cents per lb.
- Ingot brass, yellow, 13 cents; red, 15 cents per lb.

May 7.—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.50 per ton.
- Coal, bituminous, $5.25 per ton.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

New York Curb Stocks.

May 7, 1915.

	Bid.	Ask
Alaska Gold	.36	.36¼
British Copper	.00¾	.01
Braden Copper	.08	.08⅛
California Oil	296.00	299.00
Chino Copper	.46½	.47
Giroux Copper	.01	.02
Green Can.	.30	.32
Granby	.86	.86¾
Miami Copper	.25⅞	.26⅛
Nevada Copper	.15	.15¼
Ohio Oil	140.00	142.00
Ray Cons. Copper	.24½	.24¾
Standard Oil of N. Y.	185.00	187.00
Standard Oil of N. J.	406.00	409.00
Standard Oil (old)	1325.00	......
Standard Oil (subs)	915.00	......
Tonopah Mining	.07⅛	.07⅜
Tonopah Belmont	.09¼	.09⅜
Tonopah Merger	.36	.37
Inspiration Copper	.31⅝	.31⅞
Goldfield Cons.	.01½	.01 9/16
Yukon Gold	.02¾	.03
International Nickel	...	145.00

Porcupine Stocks.

	Bid.	Ask
Apex	.03¾	.04
Dome Extension	.09¾	.10
Dome Lake	.16	.17
Dome Mines	12.25	13.00
Foley O'Brien	.30	.33
Hollinger	25.20	26.00
Jupiter	.12¼	.12½
McIntyre	.50	.52½
Moneta	...	.05½
Pearl Lake	.01	.01⅝
Porcupine Gold	.00½	.00⅞
Imperial	.07	.07½
Preston East Dome	.02½	.03
West Dome	.04¼	.04⅝
Porcupine Crown	.80	.83
Teck Hughes	.04	.05
York, Ont.	.07	.08½

Cobalt Stocks.

	Bid.	Ask
Bailey	.02½	.02¾
Beaver	.35½	.36
Buffalo	.55	.75
Chambers Ferland	.18	.22
Crown Reserve	.85	.89
Foster	.03¼	.05
Gifford	.02	.02¾
Gould	.00⅛	...
Great Northern	.02½	.03½
Hargraves	.01	.01½
Hudson Bay	19.00	...
Kerr Lake	4.85	5.10
La Rose	.50	.60
McKinley	.29	.30
Nipissing	6.05	6.13
Peterson Lake	.22½	.23
Right of Way	.04	.04½
Leaf	.03	.03¼
Temiskaming	.35½	.36
Trethewey	.14	.16
Wettlaufer	.03½	.05
Seneca Superior	1.00	1.35

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario	Haultain, H. E. T.	**Quebec**	**British Columbia**
Cohen, S. W.	Segsworth, Walter E.	Burchell, Geo. B.	Brown & Butters.
Campbell & Deyell.	Smith, Alex H.	Cohen, S. W.	Fowler, S. S.
Carter, W. E. H.	Smith, Sydney.	DePencier, H. P.	**FOREIGN-New York**
Ferrier, W. F.	Maurice W. Summerhayes.	Hardman, J. E.	Canadian Mining & Exploration Co., Ltd.
Forbes, D. L. H.	Tyrrell, J. B.	Hersey, Milton L.	Colvocoresses, Geo. M.
Gwillim, J. C.		Johnson, W. S.	Dorr, Jno. V.N.
Hassan, A. A.		Smith, W. H.	Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

CANADIAN MINING AND EXPLORATION CO., LIMITED
WILLIAM WALLACE MEIN, Consulting Engineer
Mining Properties Purchased or Financed
43 Exchange Place, New York. Cable: Cameco, New York.

CARTER & SMITH
Consulting Mining Engineers
Hermant Building, 19 Wilton Ave.
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montrea
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
Chuquicamata, Chile
Chief Construction Engineer for Chile Copper Co.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

JOHN V. N. DORR
Consulting and Metallurgical Engineer
17 Battery Place New York City
and
First National Bank Building
Denver, Colorado

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

LAWYERS

ASSAYERS, CHEMISTS AND ORE TESTERS.

BUYERS AND SELLERS OF METALS

The Canadian Miner's Buying Directory.

Air Hoists—
Canadian Ingersoll-Rand Co., Ltd.

Amalgamators—
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.

Assayers' and Chemists Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Ball Mills—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Mussens, Ltd.

Beams—Steel—
Dominion Bridge Co.
Mussens, Ltd.

Belt Tighteners and Clamps—
Dodge Mfg. Co., Ltd.

Belting—Leather, Rubber and Cotton—
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

Blasting Batteries and Supplies—
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited

Blowers—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

Boots—
Dodge Mfg. Co., Ltd.

Buckets—
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

Chain Blocks—
Mussens, Ltd.

Chemists
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Mining Exposives—
Curtis & Harvey (Can.), Ltd.
Canadian Explosives, Limited

Coal Mining Machinery—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Collars—
Dodge Mfg. Co., Ltd.

Compressors—Air—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Concentrators and Jigs—
Fraser & Chalmers of Canada, Limited.
James Ore Concentrator Co.
Mussens, Ltd.

Concrete Mixers—
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Condensers—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Peacock Bros.
Northern Canada Supply Co.

Conveyors—Belt—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Converters—
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.

Conveyor—Trough—Belt—
Hendrick Mfg. Co.

Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.

Cranes—Electric—
Mussens, Ltd.

Cranes—Overhead Traveling—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Crane Ropes—
Mussens, Ltd.
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Lymans, Ltd.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamonds (for Diamond Drills)—
Abe. Levine.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith and Travers.

Dredging Machinery—
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.

Drills, Air and Hammer—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Mussens, Ltd.

Dump Cars
Sullivan Machinery Co.
Mussens, Ltd.

Drills—Electric—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.

Elevator Cups—
Dodge Mfg. Co., Ltd.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Oil—
Peacock Bros.
Boving & Co. of Canada, Ltd.

Engines—Crude Oil—
Boving & Co. of Canada, Ltd.

Engines—Steam—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Fans—Ventilating—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.

Fixtures—Counter Shaft—
Dodge Mfg. Co., Ltd.

Flights—
Hendrick Mfg. Co.

Floor Stands—
Dodge Mfg. Co., Ltd.

Friction Clutches—
Dodge Mfg. Co., Ltd.

Forges—
Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

Hoisting Engines—
Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 11

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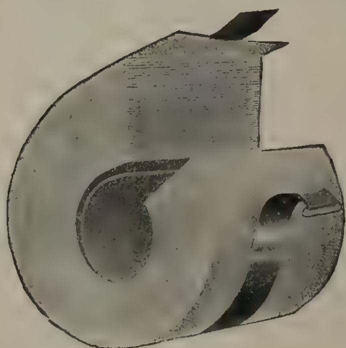

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THE CANADIAN MINING JOURNAL

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REGINALD E. HORE

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CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post-office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879.'

BALL MILLS AND STAMPS

Now that the Vipond and McIntyre mills have been in continuous operation for several months, interesting comparisons are being made between the plants using rolls and ball mills and those using stamps for the main crushing operation in treating Porcupine gold ores.

The large plants, Dome and Hollinger, are equipped with stamps, and most of the published data on Porcupine metallurgical processes is that which has been gathered at these two plants. Comparisons have been made with results obtained at the Vipond and McIntyre; but these have been of a rather general nature and unsupported by actual figures. Such figures should now be obtainable, and there seems a probability that the rolls and ball mills will make a better showing than the stamps.

In a paper written for the Canadian and American Mining Institutes, and published in the February 15 issue of this Journal, Mr. Noel Cunningham says:

"At the Vipond and the McIntyre mills, rolls and ball mills are doing the work done by stamps at the other mills. The ore is chiefly soft schist and the ball mills have been entirely satisfactory; power per ton of ore ground appears to be slightly higher than with stamps for the production of identical results. Steel consumption is about the same, the stamps perhaps having a shade the better of the argument in this respect; cost of operation and repairs is in favor of the ball mill, while first cost and uniformity of operation (what might be termed lack of operating "grief") are decidedly in favor of the ball mill. While my own experience in the district has been entirely with stamps, and their performance was satisfactory, I am of the opinion that the ball mill is preferable for breaking down the Porcupine ore ahead of the tube mills."

Mr. C. H. Poirier, who designed the Vipond plant, says in its favor that first installation and upkeep is less than one-half that of stamps for equal capacity, that the capacity in tons per horse power is double, and that there is a reduction of one-quarter the amount of solution required, and consequently reduction in cost in handling solution after crushing. Overhead mill space is also reduced one-half.

Mr. Cunningham, on the other hand, states that power per ton of ore ground appears to be slightly higher than with stamps. He says that the latter crush 5 to 6 tons per 24 hours per horse power.

At the recent meeting of the local branch of the Canadian Mining Institute the topic was discussed; but no figures were presented.

As long as power remains one of the chief problems in Northern Ontario, it is of vital importance that the cost of power for milling operations be very carefully determined. It is to be hoped that an open discussion will take place in order that the experience gained may be promptly taken advantage of. We will be pleased to publish contributions to the discussion.

PORCUPINE ORES AND ROCKS

The ores and rocks at Porcupine have been variously described. Owing to the completely altered character of the wall rocks there is difficulty in determining to which of the more common igneous rock types they should be referred. This is, however, no excuse for calling the laminated ore an "iron silicate schist," as one prominent metallurgist does.

Some geologists at Porcupine call the schistose wall rock a basalt schist. For this terminology some support might be found, for there is a possibility that the rock may have been originally a basalt. Otherwise the term is a misnomer.

Why not call the rock what it is, instead of what it may have been once. The wall rock in most places is a grey schist composed largely of carbonates and quartz, with numerous minute flakes of sericitic mica and grains of pyrite. In places the wall rock is of darker color, owing chiefly to the presence of numerous particles of chlorite. In the vicinity of the Hollinger and the McIntyre mines, the wall rocks are such carbonate schists, some grey and sericitic, some darker colored and chloritic. At the McIntyre the wall rock in places is a less altered rock which retains its distinctly igneous character. It is a porphyry which, in the opinion of the company's geologist, Mr. Whitman, intrudes the schists.

THE CRIME OF THE LUSITANIA

A new adjective, "lusitanian," is suggested by a New York newspaper as a probable addition to the languages of the world—with the exception of German—for the proper describing of deeds of such gigantic and incredible infamy as the sinking of the "Lusitania," should the future of the race bring forth another such crime, a crime to which the past presents no parallel.

This is as it may be, but there is crystalizing in the consciousness of all nations, outside the league of the Teuton and the Turk, one sharp-edged adamantine fact, the certainty that to this generation and many yet to come the name "German" will be a synonym for calculating cruelty, for barbarism expressed in the terms of twentieth century scientific efficiency, for the primeval instincts of lust and murder carried into effect by submarine torpedo-boats, by Zeppelin bombs, by the truly Prussian weapon of gas fumes—a "technical device" designed not merely to kill—but to cause a death of lingering agony that exceeds in exquisite diabolism the refinements of the Chinese torture known as "li-chi," and might, in the words of Coleridge, give the Devil an idea "for improving his prisons in hell."

We will say nothing about the existence of a calculated system of "frightfulness" as disclosed by the report of the British Commission on the Belgian Atrocities, except that it should be read by any persons who may yet have lingering doubts on the authenticity of the Belgian horrors.

From time to time in the history of the world have barbaric hordes emerged from the North and East and written a record of horror, but future historians will place the German name higher on the shameful roll of savagery than Tartar or Hun, than Vandal or Turk, than the Dervishes of the Sudan, or the "assassins" of the Old Man of the Mountain.

Great has been the opportunity of the German nation. Appalling will be its shame. Nor will the indelibility of the stain on her escutcheon be fully disclosed until Time has applied his cleansing touch to the "garments rolled in blood" which to-day screen Truth from our eyes.

Readers of Carlyle's "French Revolution" will remember his iteration of the wonderful metaphor of the upward spewing of the abyssmal morass of barbarism, the uprising of the powers of darkness and anarchy from the bottomless depths that underlie our civilization, the breaking-up of the fountains of the great deep of human wickedness; and it is against this recurrent danger that the British Empire and its Allies are to-day contending.

Our own death-roll in this warfare is high, and we know that we must steel ourselves against still greater toll of our best and our bravest. We can therefore sympathize feelingly with our friends in the United States, who, in the sinking of the "Lusitania," have experienced for the first time the ruthlessness of the Prussian doctrinaire. The death-roll of the Lusitania included notable figures in United States life, men who, not mean in their lives nor small in their achievements, proved even greater in the hour of their death, men like Vanderbilt, of whom it may be said—"Nothing in his life became him better than the leaving of it."

Among this notable list the name of Dr. Fred. S. Pearson is not the least, and perhaps he was the most notable and truly American citizen among those who perished at the hands of Germany. Dr. Pearson has played an important part in the industrial development of the whole Continent of America, for his activities included our own Dominion, Mexico and Brazil, in addition to his own country. To a large extent Dr. Pearson was the father of electric street-traction in the United States. He was a moving spirit in the early days of the Dominion Coal Company, and his ingenious and daring gift for design is still in evidence in the equipment of this company's collieries.

Regarding Dr. Pearson as typical of the group of American citizens that were murdered on the "Lusitania," we see how futile must be any attempt at "reparation" by the German Government.

We extend to the American Institute of Mining Engineers the sympathy of all Canadian members of the profession in the loss of this distinguished member, and must at the same time express our detestation of a system that has brought about this loss, that, as President Wilson has well said, "cannot be used without an inevitable violation of many sacred principles of justice and humanity."—F. W. G.

THE UTILIZATION OF OUR FUELS

Mr. B. F. Haanel, chief of the fuels and fuel testing division of the Mining Branch, has written a very instructive report on the value of peat, lignite and coal as fuels for the production of gas and power in the by-product recovery producer. The report is especially valuable, because it directs attention to means of utilizing our low grade fuels.

It is well known that Canada has enormous deposits of good coal, for Nova Scotia, British Columbia and Alberta are very large producers. But the producing districts are far apart and the central provinces have no coal. It is important that fuel should be readily obtainable in all parts of the country.

The report of Mr. Haanel shows how our peat and lignite deposits might be economically developed. Past failures are for the most part to be charged against the methods employed, rather than against the fuel.

Mr. Haanel says:

"The fuel problem which confronts Canada is, not conservation; but the best means of rendering available the various supplies of low grade fuels. The great Coal Measures of Canada are situated in the extreme east and west; but, lying between these points is a vast territory devoid of coal measures, which is, at the present time, dependent on some foreign source for a fuel supply. In one sense conservation is being practised to a very high degree, because, in certain parts of the country, practically all the coal required for industrial and domestic purposes, is being imported from the United States, while valuable fuel deposits are lying practically intact. But this kind of conservation never leads to commercial or industrial prosperity, and cannot, therefore, be recommended. In order to render those portions of Canada which are devoid of Coal Measures independent of foreign supplies of fuel, at least to some extent, it is necessary to convert into some convenient form the great source of potential energy represented by the peat bogs, which are of great extent and well distributed throughout the middle provinces; and the same necessity applies to the lignite coals which are found distributed throughout the prairie provinces.

"Many of the peat bogs, which are peculiarly adapted for manufacture into fuel for domestic and power purposes, are conveniently situated as regards transportation facilities, and contiguous industrial communities. But notwithstanding this, the manufacture of the raw peat, contained in certain of the bogs, into a marketable fuel has not, up to the present time, met with much success; due, on the one hand, to the long list of failures recorded by those who have impracticably interested themselves in this problem during the past years, and on the other hand to unscrupulous speculators, promoters and so-called inventors. The failures, so far recorded, may be ascribed principally to the methods employed for manufacturing the fuel. It is a fact that a flourishing and permanent peat industry has been established in Europe for almost a century, but no one, in this country, thought of turning to the European peat-using countries for advice and enlightenment concerning the best process to employ for the manufacture of peat fuel in Canada. This seems incredible, especially at the present day, when the inventor of processes is still able to hold the attention and sometimes the purse strings of astute business men.

"In Europe the annual production of peat is large. In Russia alone, during the last year, over 2,500,000 metric tons were produced; together with a large output in Germany, and other countries. The process employed in all the European countries is the air-dried machine peat process, sometimes called the "wet process"; and this is the only economic process for the manufacture of peat fuel known to-day.

"Unless the manufacture of peat fuel is conducted on a bog situated reasonably near a community which is able to take over the entire output produced, peat manufactured for domestic or fuel purposes alone would not prove a profitable venture. This is due to the comparatively low heating value of the peat, to its moisture content, and to the large volume it occupies, per heat unit, as compared with coal; and when to these disadvantages is added that of high freight rates per ton, the reason of the foregoing statement will be obvious. But while peat may serve as a domestic fuel in only certain cases, it may be well adapted for the production of power, or as a fuel gas. This is especially so in the case of peat, which has a high nitrogen content, since this element can be profitably recovered in the ammonia gas formed in the by-product recovery producer. According to the process employed in by-product recovery work, the ammonia gas is fixed with sulphuric acid, and the resulting product "ammonia sulphate" is then sold for agricultural purposes. The demand for this commodity is, to-day, greater than the supply, consequently its price per unit is somewhat high. Whenever, therefore, the nitrogen content of the peat is sufficiently high, the production of a fuel, or power gas, accompanied by by-product recovery, would prove profitable. But in the case of the production of power, the same economies must be introduced into the manufacture of the fuel that apply to a domestic fuel, and even though the content of nitrogen is well above the average, any increase in the cost of fuel rapidly decreases the expect-

ed profits. Peat is a low grade fuel which must be manufactured and sold at a comparatively low cost, if it is desired that it should serve as a substitute for coal. It is evident, therefore, for the foregoing reasons, that the manufacture of peat fuel does not hold forth any glowing prospects for getting rich quickly, although reasonable and very good profits should in almost every case be realized when the industry is run on a business-like basis. But the element of speculation, and some of the commonly practised methods of promotion must be eradicated if the peat industry is ever to become an accomplished fact.

"There are certain bogs in Canada, of very large extent, well suited for the manufacture of peat fuel for domestic purposes, and the production of power, and such bogs might be cultivated and colonized. All plowing, harvesting, etc., could be performed by electric power, and the homes, in addition, lighted by electricity. In this way, a worthless tract of land could be converted into agricultural land of value."

In his report, Mr. Haanel has described, in some detail, the methods for manufacturing peat fuel, and has laid considerable stress on the problems encountered in removing by pressure or by means of artificial heat the contained water. It is shown that the artificial drying of peat cannot be accomplished economically, and that to attempt to reduce the water content of the raw peat to below 76 per cent. by hydraulic pressure will result in commercial failure. It is further shown that, with peat costing $1.50 per ton delivered at the producer plant, and having a nitrogen content of 1.5 to 2 per cent., power can be produced as cheaply as with some hydro-electric plants; and, that where only gas is generated, the revenue derived from the sale of the ammonium sulphate produced is sufficient to pay a profit on the investment, and to deliver the gas free of charge.

The announcement of the Calumet and Hecla Mining Co. that on June 12 all employees will share in a distribution of about $500,000 has naturally been well received by the miners. Early in the war the price of copper was so low and demand so poor, it was found necessary to make a great reduction in output. Rather than dismiss a large number of men the company announced a lower scale of wages and shorter working hours. Then came the great rise in the price of copper, and the old wage scale and full working time were restored. Now the company is undertaking to pay the difference between what the employees earned and what they would have earned at the regular scale of wages. The Calumet and Hecla Company has many good things to its credit besides the dividend record.

There should be an important branch of the Canadian Mining Institute in the Sudbury district. There are many engineers there.

The reorganization of the Porcupine branch of the Canadian Mining Institute was an immediate result of the excursion of the Porcupine branch to Cobalt. Such excursions are greatly to be desired. The Porcupine branch should visit Cobalt, and both should visit the Sudbury district.

The demand for benzol and toluol for war purposes is giving a great stimulus to the by-product coke oven industry. The high price now being obtained for these substances is being taken advantage of by several firms in Canada and the United States. The plants now being built to make supplies for the Allies will later on help to establish other industries here.

During the early months of the war cargoes of copper for Italy were held up at Gibraltar until guarantees were given that the metal would not be transhipped to the enemy. Copper is now going across the border in large quantities; but the form in which it is being delivered is not calculated to be highly acceptable to the Austrians.

HOLLINGER.

Hollinger Gold Mines, Ltd. made a gross profit of $141,457 in the four week period ending April 22nd.

The mill ran 87 per cent. of the possible running time, treating 27,183 tons, of which 22,952 tons was Hollinger ore and 4,231 tons was treated for the Acme Gold Mines Limited.

The average value of Hollinger ore treated was $10.40. Milling cost on 22,952 tons was $1,033 per ton.

Shortage of water power interfered somewhat with operations throughout the four weeks. The spring thaw has occurred and there is now ample power for all purposes.

GRANBY CONSOLIDATED.

Although directors of Granby Consolidated took no action on the dividend at their Tuesday's meeting, it should not be considered finally settled that there will be no dividend action during the company's fiscal year which ends June 30. A special session of the board may be called early in June to place the stock back in the dividend ranks later in the month.

Granby's earnings were never so large and in this prosperity the stockholders will share. As the floating debt has not actually been paid off, although arranged for, this situation doubtless resulted in decision to defer dividend declaration for a few days. On June 1 this debt will have been eliminated.

Development work at Hidden Creek will be pushed this summer. The 9,000,000 tons of known ore reserves will, it is expected, be materially increased.

By July 1 the fourth furnace at Hidden Creek should be ready to be blown in, and from that time on the new plant will be in position to keep three furnaces in continuous operation. The nominal capacity of the plant as it stands has been considerably exceeded, which has been a factor in the low costs already attained.—Boston News Bureau.

ALIEN ENEMIES

The latest infamy of the Germans has caused a feeling of intense bitterness throughout the world and the crystalization into something resembling genuine hatred of public opinion throughout the British Empire. The systematic destruction of German property in Johannesburg, rioting in Vancouver and throughout many of the large industrial cities of Great Britain, is a reflex from the more volatile and less responsible elements of the population of the general resentment that the act of the Germans in sinking the "Lusitania" has occasioned. Up to the present time the peoples of the British Empire, and particularly those in the United Kingdom itself, have acted with supreme sanity and with an apparent realization of the seriousness of the situation, and it is a little disturbing to hear of these popular outbreaks.

As one of the magistrates sitting on the riot cases in London remarked, a proper way to show resentment against the Germans is to enlist and fight in Kitchener's army, and for any man of military age to be concerned in acts of this nature is a confession of cowardice and general undesirability on his part.

It must not be forgotten that by far the greater proportion of the law-abiding and orderly citizens of the United Kingdom are now engaged in military duty, and there must necessarily be a greater proportion of the less useful members of the community in the residue. As the Mayor of Middlesboro remarked the other day, the voluntary system of recruiting has to a large extent proved to be a process of the natural selection of the best elements of the male population, and in too many cases the men who are at the "benches" at home should be in the trenches and men who are in the trenches should be at the "benches."

Considering the wide extension and the insidious nature of the German spy system, the anxiety for the internment of alien enemies in Great Britain is quite understandable, but it is no less certain that in the carrying out of the wholesale internment order which has just been issued by the British Government, many innocent persons will suffer with the guilty.

The position of Great Britain, however, in relation to persons of alien enemy nationality is very different to the position of the British dominions. Great Britain is the nerve centre of the Empire, the most important strategic point in our world-wide Empire.

The German residents in Great Britain are to a large extent persons who displace British citizens in the different branches of industrial activity; their presence could be dispensed with in most instances without any loss to the United Kingdom. In Canada, however, as in the other British dominions, we have hitherto welcomed to our shores all desirable elements for the colonization of a great and sparsely populated country, and we expect eventually, as has been the case hitherto, to turn all our immigrants into British citizens owning allegiance to the British flag and British institutions and to none other. There should be no doubt of our ability to do this, for the power of the British Empire to assimilate other nationalities and make of them loyal citizens of the Empire is the greatest testimonial extant to the durability and the righteousness of our institutions. In a country so vast as Canada, it is inconceivable that any great material damage can result from the machinations of alien enemies, even supposing such enemies to be men of intelligence, ably led and provided with large supplies of money. As a matter of fact, however, the large bulk of persons of alien enemy nationality in Canada belong to the laboring class, and the chief thought in their minds at the present time is gratitude and thankfulness for being safe in Canada and away from the bloody business of war. Many of the countries of Europe that have yielded the greatest flow of emigration to Canada are now becoming a debatable ground, as for example, Poland, Galicia and Bukowina. It is more than probable that the territory which lies between the present frontier of Russia and the Carpathian Mountains will eventually become a possession of Russia. The fate of Poland is less certain, but there seems little reason to suppose that the Poles as a nation should be consumed with any great love for either Germany, Austria or Russia. Generally speaking, with the possible exception of a minority of educated Germans and Austrians, whose antecedents and general character it should not be hard for the police to determine, the great bulk of the alien enemy population in Canada belongs to the laboring class, and they are at the present time doing useful work as producers in Canadian industries. If it was worth while in times of peace to spend large sums of money in advertsing the Dominion of Canada as a desirable home for these people, as a place which offered them a chance of independence and uplift, surely we as Canadians should have sufficient confidence in our own institutions to allow these people, so long as they behave themselves, to earn their living and add to the general prosperity of the country.

There has been a good deal of criticism of some of the large industrial concerns in Canada because of their continued employment of workmen of alien enemy nationality, and this has been particularly evident in connection with the operations of the Dominion Iron & Steel Company and the Dominion Coal Company in Cape Breton. The opposition has not arisen from the workmen of these companies, but has proceeded more from outside persons, who desire nothing better than a popular handle for an attack upon any big corporation. At the present time, workmen of enemy nationality are employed both at Sydney and in the mines at Glace Bay. They are comparatively few in numbers and the positions they hold are usually very subordinate. Nevertheless, the loss of these men would hamper to a very large extent the work of the skilled Canadian miners who depend to a large extent upon unskilled labor for the performance of the less important and usually more laborious operations connected with mining and steel making. To intern these men at the present time would not only entail a bill of expense upon the country, but would turn men who are now peaceful and law-abiding citizens into sullen and dissatisfied enemies, who would take the first opportunity that presented itself of obtaining revenge.

Their wives and families would also have to be maintained at the expense of the community, and there would be added all the evils of concentration camps, moral and physical, among which the possibilities of political mal-administration and reprisals are not the least. At the present time these alien enemy workmen are assisting in the production of coal and steel, upon which to a very large extent depends the ability of Canada to manufacture munitions of war and to transport these munitions and men to the battle line.

There seems therefore to be good reason to caution people against being led away by mistaken appeals, not to their patriotism, which is not in doubt, but to less noble feelings that lead to riots, reprisals and the infliction of indignities upon people who are merely the victims of their circumstances.

For the convicted traitor and spy, and the man who attempts to perform hostile acts in our midst, there should be a short, sharp shrift, but it should be pointed out in no uncertain way that all nationalities who have accepted the hospitality of this Dominion should, so long as they pursue their peaceful avocations and indulge in no overt acts, be allowed to earn their daily bread and otherwise be treated as potential citizens of this great Dominion.

Many persons of German nationality throughout the British Empire have repudiated the infamous deeds of their countrymen and, more than this, many Canadians of undoubted German ancestry, removed by but one or two generations from actual residence in the Fatherland, have offered their services to take arms against the common enemy of mankind.

Those persons who attempt to inflame public sentiment by the writing of incendiary articles directed against persons of enemy nationality living in our midst, or who take part in actual violence, brand themselves in the first instance as cowards, and in the second instance as traitors to the British principle of fair play and to all traditions under which our great Empire has become a refuge for the oppressed, and the beacon of liberty to distressed nationalities the world over. In a campaign of reprisals we are bound to be beaten, because, as one speaker in the British House of Lords remarked recently, "in a competition of brutality against the Germans the British people must be beaten."

DOME EXTENSION.

The annual meeting of Dome Extension shareholders was held May 27, with President W. S. Edwards in the chair. The president said that while no work had been carried out on the property, developments on the Dome indicate a bright future for the Dome Extension. He explained that drilling had proved the value of the mine, but with the present condition of the market the directors did not consider it advisable to place the million shares held in the treasury upon the market, as they would not produce enough money to carry on the work satisfactorily. The financial statement shows a cash balance of nearly $4,000. The board was re-elected.

CONIAGAS.

Cobalt, May 27.—The new vein cut in the west crosscut from the fourth level of the Coniagas No. 4 shaft, is the first ore made on the southern end of this property. No. 4 shaft is located on the corner of Silver Street and Prospect Avenue, one of the busy corners of the town. The new vein, located in virgin ground, shows four in. of 2,000-oz. ore, being composed of calcite, heavy niccolite, and silver. There is little smaltite associated. In the wall rock milling ore will extend over some distance. No work has been done on the vein, but a drill will be started this week to drive in a northerly direction.

MINERAL PRODUCTION OF ONTARIO

The Bureau of Mines has received returns showing the production of the metalliferous mines and works of Ontario during the three months ending 31 March 1915. The figures show gains in gold, nickel and iron ore as compared with the corresponding period of 1914, but decreases in silver, copper, pig iron, cobalt, and cobalt and nickel oxides.

	1st. 3 mos. 1915		Increase or Decrease
Gold	$1,568,043	I	365,541
Silver	2,486,909	D	1,060,647
Copper	526,338	D	65,650
Nickel	1,496	I	50,610
Iron Ore	50,592	I	37,664
Pig Iron	1,158,462	D	1,344,988
Cobalt	3,718	D	5,180
Cobalt and Nickel Oxides	19,686	D	149,279

Gold—The gold was for the most part the product of the Porcupine camp, where the Hollinger, Dome, McIntyre-Porcupine, Porcupine Crown, Vipond, Acme and Mines Leasing companies are now all turning out bullion. In other parts of Ontario the producing mines were Canadian Exploration, Tough-Oakes and Cordova.

Silver.—The number of mines marketing their products, whether ore, concentrates or bullion, was 20. One large mine made no shipments during the quarter, and others produced more silver than they sold. Present low prices of silver offer no inducement to increase production, and the shortage of water for power purposes impeded mining and milling operations. Another cause of the falling-off is the closing down or partial exhaustion of some properties which formerly produced freely.

Nickel and Copper.—The nickel-copper mines are working at high pressure. The Creighton mine is employing 750 men underground, and a seventh furnace is being put in at the Copper Cliff smelter. At Coniston the Mond Nickel Company is working every Department at full capacity.

Iron—The Helen was the only iron mine making shipments during the quarter. The market for pig iron is depressed, and there will be a restricted output until a decided improvement is apparent in the demand.

Oxides—The war has shut off all exports of cobalt or nickel oxide to the continent of Europe, where the materials, particularly the former, were in demand.

INVESTIGATION OF PEAT BOGS.

The Mines Branch, Ottawa, has issued a report on an Investigation of the Peat Bogs and Peat Industry of Canada by A. v. Anrep.

This report includes a detailed examination of nine peat bogs in the Province of Quebec, and on account of a preliminary investigation of a number of peat bogs situated in the immediate vicinity of Sudbury and Sellwood, in the Province of Ontario.

ACCIDENT AT NANAIMO.

Nanamio, B. C. May 27.—About 40 miners were trapped by a gas explosion in the reserve mine of the Western Fuel Company here late to-day. Sixteen have been rescued and two bodies recovered. The fate of the others miners, who are still imprisoned, has not been determined.

THE PRINCIPLES UNDERLYING THE OCCURRENCE OF OIL AND GAS AND THEIR APPLICATION TO WESTERN CANADA

By Justin S. DeLury

In this article an attempt will be made to show, from the similarity of geological conditions in Alberta and other parts of western Canada to the usual conditions accompanying the hydrocarbons throughout the world, that great possibilities await the exploiters of petroleum and natural gas in these western fields. It is recognized that the economic geologist cannot reason safely from analogy; at the same time, he would be wrong, while investigating one field, in disregarding conditions in other fields and refusing to apply them. Without the presumption of trying to show that western rocks are reeking with oil, there will be no harm in pointing out the similarity in conditions in these fields to the proved oil and gas fields of the world by means of a geological comparison.

Oil and gas occur in rocks of all geological ages from Silurian to those of recent formation. Of the oil and gas fields of the United States, which has a much greater production than any other country, the largest, or Appalachian field, has the oil and gas distributed in many favorable formations of a great series of Palaeozoic rocks. The Ohio-Indiana, the mid-continental of Kansas and Oklahoma and the Illinois fields are all represented by Palaeozoic formations, generally by the younger groups. California oils are found in rocks ranging in age from Jurassic to Quaternary time, but are chiefly in the Tertiary. The Texas-Louisiana oil-bearing strata are of Cretaceous to Quaternary age. Colorado and the bulk of Wyoming oils are in Cretaceous. In Alaska, formations from Jurassic to Tertiary are the favorable ones. Most of the oils of Europe and Asia are in rocks of age from Jurassic to Tertiary, frequent occurrences being known in even the latest of the Tertiary formations.

Oil and gas reservoirs.—Any porous rock or cavity or open fissure may be a reservoir for oil or gas, provided that other conditions are suitable. Sandstones are the most abundant of the very porous rocks and are, as would be expected, the most important oil and gas holders. Porous limestones also hold large quantities. Rocks made porous by fracturing and fissuring may and do hold workable pools. Series of alternating sandstones, shales and limestones seem to offer the best facilities as a source and place of accumulation for the hydrocarbons. If these rocks exist with the proper structural relations, we have what may be described as geologically possible oil and gas ground.

Besides a porous rock to serve as a reservoir, there is needed an impervious overlying rock to keep the hydrocarbons from gaining access to the surface, where they would be lost. In general, oil and gas are collected in the highest underground places they can reach, and most of them are under a pressure sufficient to cause their escape through any but the most impervious rocks. As a rule, oil and gas are found under a stratum of damp clay or shale, which is the common impervious rock in the sedimentary formations. It is on account of the general tendency of the lighter hydrocarbons to work upwards, evidently driven and compressed by water currents from below, that they are generally found in the apex of low anticlines or domes in the strata. There have been doubts cast on the applicability of the anticlinal theory of accumulation of oil and gas, but, with a few exceptions, it has proved to be, when combined with good judgment, the only valuable hypothesis of general application available for the prospector. In areas where dry wells exist, the hydrocarbons, not being under the influence of underground waters, are likely to be found in an opposite condition than would be indicated by the anticlinal theory. In some of the other fields where the application of this theory has failed, local conditions seem to upset the applicability of the theory rather than the theory itself.

Gas nearly always accompanies oil, but the finding of gas in a well, on the other hand, in no way assures us that oil will be found, though it may be regarded as a favorable indication of the presence of oil. As a general rule, where the two are found, the gas is above the oil; this does not exclude the possibility of there being two horizons, one above the other and each containing both of the hydrocarbons. On account of these definite relations between gas and oil, it is important that an oil well be sunk in the right place to avoid complications with gas in getting the oil and to make use of the pressure of the gas to force out the oil.

Surface indications.—Oil and gas pools have been located without any real surface indications beyond formations and structures which would indicate geologically favorable ground. These formations and structures point to a good locality for prospecting, but as a rule surface indications are looked for and are desirable, especially in unproven territory. In most of the fields that have been discovered there have been gas springs and often oil seepages. These escapes generally, and especially in a plains country, indicate that the hydrocarbons are under pressure and that they are of the normal type. Having found surface indications, the general structures of the area are examined in order to find the most likely location of the reservoir. As a rule it is found at the crest of an anticline. If the anticline is low or the rocks are horizontal, it is more difficult to decide on the best location for a well, and it is then that surface indications in the way of gas escapes under pressure and oil seepages from below may prove helpful in giving a clue as to the location of the pools.

In summing up the principal features in regard to oil and gas formations, it might be said that favorable conditions are afforded by thick series of sandstones, conglomerates, limestones and shales of age from Silurian to Recent, that have been left undisturbed except for general elevation or have suffered only minor folding. The conditions which are essential for the accumulation of large pools of oil and gas are: first, a source for the oil; second, porous rock to serve as a reservoir; and third, an impervious stratum to prevent escape. The sources generally favored by geologists are thick beds of shales, preferably those which show evidence of abundant life, either animal or plant or both, and limestones, which in themselves always

give evidence of animal life. The reservoir rocks that favor accumulation are sandstones and porous limestones. The impervious stratum that prevents escape is nearly always a clay or shale and generally a wet one. The following conditions, while not essential, favor the storing of the hydrocarbons; first, the occurrence of low anticlinal arches or domes; and second, the saturation of the surrounding rocks with water. Surface indications, though not essential for sane prospecting, give confidence and sometimes aid to the operator.

Application of principles to Western fields.—Before applying the above principles to Western fields, it might be well to point out that there are places in which the essential conditions and many of the favorable ones exist, which do not yield oil or gas. In other words, there are areas which are geologically possible and some even geologically probable, which do not yield oil and less often gas.

For the purpose of applying the principles underlying the occurrence of petroleum and natural gas as outlined above, to conditions in Western Canada, a brief outline will follow, of the geology of a wide belt lying east of the Rocky Mountains and extending from the United States on the south to the Arctic ocean on the north.

The accompanying table of formations, compiled from the reports of the Geological Survey of Canada, include formations recognized over considerable areas and those of interest in connection with the hydrocarbons.

Tertiary.—Paskapoo. Exposed over large areas in Western Alberta. Light colored sandstones with bluish and greenish shales. In the foot-hills there is a thickness of over 5,000 ft., but the formation thins out on the plains. In the southern and western fields of United States, there are evidences of oil in rocks of similar age. Fossils indicate a fresh water origin.

Cretaceous.—Edmonton. St. Mary river beds of southern Alberta. Large areas exposed in central and western Alberta. A series of light colored clays and sands containing coal seams and forming a brackish water transition formation between the fresh water Paskapoo and the marine Bearpaw series. Thickness is at least 700 ft. in central Alberta. North and west of Edmonton are surface indications of oil. The Edmonton and Paskapoo beds in this area represent the transition period between the Cretaceous and Tertiary, known as the Laramie.

Bearpaw. (Pierre-Foxhill). Exposed in large areas in the foot-hills, in central and eastern Alberta, in southern Saskatchewan and southwestern Manitoba. Mostly marine, but in places, brackish and fresh water formation. Variable thickness up to and over 1,000 ft. No authentic indications of oil.

Belly River. (Judith River). Sandstone and shale formation resembling the Edmonton. Thickness up to and over 1,000 ft. Similar age to Dunvegan beds in the Peace River area. Found in the foot-hills and over a large part of southeastern Alberta. Indications of oil, and gas have been found in several places in Alberta in this series.

Niobrara-Benton. Shales, some calcareous and many dark colored and sandstones. From a few hundred feet in thickness on the plains to several hundred in the foot-hills. Marine origin. Oil is found in rocks of this age in the Western States and there are indications in Canada. Besides the occurrence in the foot-hills, there is a large area exposed in the Athabaska River country, north of Edmonton.

Dakota. Fresh water sandstones in southern Alberta. Marine sands in northern Alberta. Gas wells between Bow Island and Medicine Hat have good flow and strong pressure. Farther north on the Athabaska country, the Dakota seems to have served as a reservoir rock for oil coming from underlying Devonian limestones.

Kootanie. Sandstones and shales found in the Rocky Mountains and their foot-hills. Found in Dakota and Montana on the plains, so will likely be found to underlie the younger formations over large areas of the Canadian plains.

Jurassic.—Fernie Shale. Black and brownish shales of marine origin, found in the mountains and foot-hills and varying in thickness from 1,600 ft. in the former to 200 ft. in the latter. They are traceable north to the Athabaska. It is probable that they may continue for some distance eastwards from the foot-hills as a gradually thinning formation.

Triassic.—Upper Banff Shale. Red, sandy shales, capped by a bed of limestone. Traced north to the Brazeau and probably correlated with the Triassic of the upper Peace and Pine river areas. Marine origin.

Carboniferous.—Thick beds of limestones occur in the Rocky Mountains and may continue eastward into the plains as a thinner formation.

Devonian.—Like the Carboniferous, they occur in the mountains and probably continue eastward as a hidden formation. Limestones of this age are found over large areas from northern Alberta to the Arctic. Here, they are of special interest as being the probable source of the oil that impregnated the tar sands.

The country lying to the north and northwest of Alberta has been only slightly studied by geologists, and very few of the formations found there have been assigned to their definite horizons. It is well known, however, that large areas of Tertiary, Cretaceous and Devonian and probably Jurassic-Triassic rocks are exposed in this wide belt.

The following list of the probable succession of events, compiled from the areal geology, will give an idea of the structural geology:

1. A subsidence of probably the whole of the area in Canada between the Cordilleras and eastern Manitoba as far north as the lower Mackenzie basin, throughout Palaeozoic times, is evidenced by the exposures of a fairly complete series of Palaeozoic formations in Manitoba and in the Rocky Mountains, and by the extensive occurrence of Devonian limestone in the Mackenzie basin.

2. At the close of the Palaeozoic, there was probably a fairly general emergence, as submergence during early Mesozoic times is represented only by a belt of Jura-Triassic rocks appearing in the Rocky Mountains and widening to the north.

3. During Cretaceous times, there was an oscillation of the crust, providing alternating land, shallow water and marine formations, and too complicated to allow even a brief outline of the succession of events.

4. Oscillation of the crust continued during the Laramie and was followed by a general upward movement of the Rocky Mountain area.

5. Tertiary lakes probably covered considerable areas east of the mountains.

6. Elevation, erosion and later glaciation.

It will be of interest to know: the thickness in different localities of the several Cretaceous formations east of the mountains; to what extent the Palaeozoic and early Mesozoic underlie the Cretaceous on the plains; and whether the structures of the older formations below, conform with the newer ones above.

Information on these points will be of interest in the search for oil and gas.

Important flows of gas have been met in several parts of southern Alberta and some also in central Alberta. Farther north, especially in the vicinity of Athabaska river, there are evidences both from borings and from natural gas escapes, of great accumulations over wide areas.

The outlook for oil in southern Alberta has been brightened by the recent finds and reports of occurrences near Calgary and at points farther north. But it is in the northern part of Alberta and in the vast area to the north and west of that province, that the best surface indications of the existence of oil are to be found.

Cairnes, in his report on the Moose Mountain district of southwestern Alberta, says: "There are several likely gas horizons in this district, any or all of which may be gas-producing at favorable points. Medicine Hat gas comes from about the middle of the Belly River formation; Langevin gas comes from the same horizon; the Cassils gas is from a higher horizon, just at the bottom of the Pierre. There is also a likely horizon at the bottom of the Edmonton, and one higher in the same formation." Of the indication of gas in the country between the Peace and Athabaska rivers, McConnell writes: "The natural gas springs have less value in themselves at present than in the indications they afford of the existence of petroleum beneath." Referring to the bitumens found in the valley of the Athabaska, the same writer says. "The tar sands represent an upwelling of petroleum to the surface unequalled elsewhere in the world, but the more volatile and valuable constituents of the oil have long since disappeared, and the rocks from which it issued are probably exhausted as the flow has ceased. In the extension of the Tar Sands under cover the conditions are different, and it is here that oils of economic value should be sought." He then points out that in other parts of the field the corresponding sands are overlaid by impervious shales, and that there is a probability that small anticlinals or other conditions in the beds and overlying shales may supply the necessary conditions for oil accumulation. Indications of oil as afforded by bitumen are not confined to the above locality, but are found on Peace river, Lesser Slave lake, and in many parts of the Mackenzie basin where Devonian limestones are exposed. Camsell, in a recent paper on the Mackenzie River region, writes: "The most important mineral products of the lowland portion of the basin, however, and possibly of the whole, of this portion of Canada are oil and gas, evidences of which are found from the height of land on the south to the Arctic ocean on the north. The original source of both these substances is believed to be in the Devonian rocks, and since these rocks cover about half of the total area of the whole Mackenzie basin, the possibility of discovering oil pools of importance in this region is excellent. Gas has been proven in great quantity by several drill holes, but little intelligent effort has so far been directed to the search for oil."

In summing up, it might be said that there is a wide belt of country lying to the east of the Rocky mountains and extending from the United States on the south to the Artic ocean on the north, which may practically all be regarded as geologically possible oil and gas country. The occurrence in this belt of large areas presenting all the essential conditions and many of the favorable ones for the accumulation of hydrocarbons, makes it seem not too unreasonable to classify some large parts of the belt as geologically probable fields.

It would not be right to consider the probabilities of an area without noting some of the factors which may make more uncertain the finding of oil and gas. Overlying beds may not be sufficiently consolidated to check loss. The exposure of reservoir beds by erosion, which has caused an enormous loss of oil and gas in many parts of the world, is well illustrated by the occurrence of bitumen in the Dakota sands overlying Devonian limestone in the Athabaska basin. As was mentioned, this bitumen is undoubtedly the heavy residual oils left by the lighter oils of petroleum pools which had gained access to the surface. There are also the crucial possibilities that there was not sufficient oil and gas in the original sources, and that there were not the right conditions for accumulations. Unfortunately, the investigations relative to the hydrocarbons, have not put us in a position to hazard a guess on these points, and we are forced to reason by comparison to proved oil and gas fields.

U. S. IRON PRODUCTION IN 1914.

Output of iron ore in the United States in 1914 decreased about 33 per cent. from preceding year, according to estimates of the Geological Survey.

Iron ore mined in the United States in 1914 is estimated at between 41,000,000 and 42,500,000 long tons, and quantity shipped from the mines to receiving ports and iron manufacturing centres between 39,500,000 and 41,000,000 long tons. In 1913, 61,980,431 long tons were mined. These estimates are based on preliminary reports from 52 of the important iron mining companies which represent the principal iron producing districts and whose combined output in 1913 was more than 90 per cent. of total tonnage of iron ore mined in that year.

The average decrease in quantity mined by these 52 companies was 33 per cent., compared with their output in 1913, and if this average decrease should hold for all the iron mining companies in the United States, the total output of irone ore in 1914 should approximate 41,440,000 long tons, compared with 61,960,437 long tons mined in 1913. A curve of iron ore production would, therefore, show the output of 1914 to be about on a par with that of the years 1905 and 1911.

In the Lake Superior district, where about 85 per cent. of the domestic iron ore is mined, the average decrease in production was about 37 per cent., thus indicating a total production for that district of about 32,915,000 long tons in 1914, compared with 52,516,156 long tons mined in 1913. The shipments of ore from this district apparently decreased about 34 per cent., and accordingly the shipments should approximate 32,790,000 long tons in 1914, compared with 50,168,134 long tons in 1913.

According to the preliminary reports the stocks of iron ore at the mines apparently increased more than 500,000 long tons during 1914, so that the total stocks at the close of 1914 should range between 13,400,000 and 13,500,000 long tons, compared with 12,918,633 long tons on hand at the close of 1913.

Prices generally were 50 to 75 cents a ton lower than in 1913—as low as or lower than those of 1912 and 1905. The depression in the iron industry affected seriously the lake carrying trade, which depends largely on the transportation of ore from the Lake Superior districts to ports at the head of Lake Michigan and at the foot of Lake Erie.—Boston News Bureau.

NEWFOUNDLAND

By P. B. McDonald.

There has long been talk of Newfoundland becoming part of the Dominion of Canada; but nothing has resulted from it and nothing is likely to. Newfoundlanders do not care for nor take to the idea, any more than they sympathize with the ideals of the other great country to the south of them the United States. Possessed of an island of 42,000 square miles (which is more than the area of Ireland), and with important privileges in Labrador, this quarter of a million people who have grown up mostly along their far-away east coast, desire principally to govern themselves, live their own lives, and continue undisturbed in the practice of the old-fashioned ways they like best.

It is realized in St. Johns that, in case of confederation, many of their present businesses and viewpoints would appear out-of-date; and it is not entirely clear that the sudden grafting of modern ways on a people devoted to other standards would be as satisfactory as the promoters claim. It must be understood that primarily and fundamentally Newfoundland is a coast line, four or five hundred miles from anywhere, out of touch with railroads and possessed of interests and knowledge only in fishing, shipping and the like.

Mineral Resources of Newfoundland.

Iron—In a mineral way, Newfoundland is of course famous for its two great iron mines under the storm-lashed waters of Conception Bay. Their product, a blocky, hard ore of excellent furnace qualities, is known in all the principal iron markets of the world. With a location on tidewater in the North Atlantic, shipping to America or Europe is equally convenient. It is these two great mines, owned by the Dominion Iron & Steel Co. and the Nova Scotia Steel & Coal Co., which German interests identified with Krupps were so anxious to acquire when, as they fondly hoped, the British colonies would fall to them. Both of the companies on Bell Island have developed their iron ore seams in the most up-to-date manner for the economical handling of large tonnages, and the long slopes extending under the sea for thousands of feet can produce immense quantities of ore for conveying across the little island to sheltered anchorage where the ore steamers are loaded.

Newfoundland's iron ore is accessible, developed, sure. There are many millions of tons in reserve and the various conditions of success, such as labor, transportation and cost have been worked out satisfactorily.

Other Minerals.—Aside from the Bell Island iron mines, whose accessibility is exceptional, the mineral wealth of the colony is locked up from lack of roads and by the general difficulties of doing business in a far-off barren wilderness where the expenses of development become prohibitive. In addition, much of the land liable to become valuable is held by individuals or companies waiting for the boom that never comes. Coal, oil, metals, are known to exist, particularly along the desolate west and south shores; but the combination of qualities necessary for their successful development has never materialized.

Copper ore and pyrites have been mined in Notre Dame Bay on the northeast coast, and several English and one or two American companies have made some profits. The Cape Copper Co. in particular, an English company which operated for many years around Tilt Cove, has been successful in its ventures and is still working, though with reduces forces, at a new prospect farther north.

Operation difficulties.—Occurrences of valuable minerals of various kinds have been noted scattered over the island. A few attempts have been made at developing them. In the majority of cases the difficulties inherent in so doing are tremendous. A band of oil-drillers or miners set down on a lonely bit of coast with instructions from London or Montreal to proceed in a certain manner, soon run into complications which they find difficult to explain to far away directors. Back from the fishing villages there are no roads. Transportation is slow and expensive. Mails are tedious and the barren, desolate country gets on the nerves of the workmen. Due to peculiarities of the problems encountered, it requires an unusual combination of qualities in a superintendent or responsible head to achieve the initial results aimed at, so that when irregularities, which must be expected are met with in the geological nature of the deposits, it is usual to find disagreement among the directors as to the proper course to pursue. The entire undertaking is a venture requiring optimism and agreement in all matters to make the necessary difference between success and failure.

Undeveloped coal ond oil—Thus, there remain undeveloped the important coal areas in the southwest section undoubtedly a continuation of the Cape Breton occurrences and the oil fields at Parsons Pond farther north along the west shore. The former have been withheld to a certain extent by landholding interests with exorbitant ideas as to their recompense for being there first, and the titles are a little clouded by litigation. The oil lands had a start at being drilled several years ago when a British company engaged some American well-drillers from the Pennsylvania field, but difficulties and disagreements arose and the work was finally stopped after a few holes had been put down and one small well discovered.

Other attempts at mining gold, copper, and miscellaneous minerals have not succeeded much better. It is not that the substances are not there in at least moderate quantities and values, but the extraordinary problems of profitable extraction and marketing have proved too great for the continuance of effort necessary for a final success.

At present there is talk of a big industry to employ between one thousand and two thousand men for the west coast at Bay of Islands. The company is known as the Newfoundland Products Co. with a capital in the millions, and the government is passing on water powers, land and mineral grants, in accordance with the company's intention to manufacture carbide phosphates, etc. It is possible that, as time goes on, the west coast, where are said to be the most attractive lands for settlement in the island, will build up to some comparison with the Nova Scotia side of the Gulf of St. Lawrence. The natural conditions there for varied industries are more favorable than along the other shores where fishing will undoubtedly continue to be the staple calling. The west coast has coal, oil, water-powers, the most attractive areas of real soil on the rocky backbone of the island, and is more adjacent to the mainland. As things are now, however, the great bulk of the colony's population lives in the numerous bays on the storm-beaten east coast. The west coast, like the south and north coast, is a vast, lonely expanse of desolateness and solitude.

STRUCTURAL FEATURES OF THE ALBERTA OIL FIELDS*

By D. B. Dowling.

The interest which has been aroused in prospecting for oil in the foot-hills of southern Alberta, and in the oil-possibilities of the known gas-fields situated in the less-disturbed areas, called for a much closer examination of structure, thickness, and composition of the underlying rocks of the region than had hitherto been made. The areal geology of the larger part of the great plains was outlined by Dawson, McConnell, and Tyrrell, between 1881 and 1885. The foothill area was not critically examined at that time, owing to the time which would have been required for its proper study and the difficulty that was found in recognizing in the foothills the divisions which had been adopted in the mapping of the formations of the plains. This was due in great measure to the paucity of exposures in continuous sections of the lower divisions of the Upper Cretaceous. Since the pioneer work in the plains was published, the beds which form continuations south into Montana have been critically examined.

The structure of the outer portion of the foothills has been partly mapped and a comprehensive view of its general character may be gained from the accompanying sketch and sections, Figs. 1 and 2. It will be seen from them that there was an uplift of the lower measures toward the mountains, accompanied by profound fracturing throughout the disturbed zone. Since the lines of fracture penetrate below the beds containing the possible oil supply the fault blocks have necessarily a limited oil-drainage area and do not afford promising ground for wells. Our field of study has been limited, therefore, to the eastern edge of the broken country in the hope of finding anticlines in close connection with the less-disturbed beds of the Alberta syncline which lies to the east. One of these on Sheep Creek is being thoroughly prospected and one well is now producing a small quantity

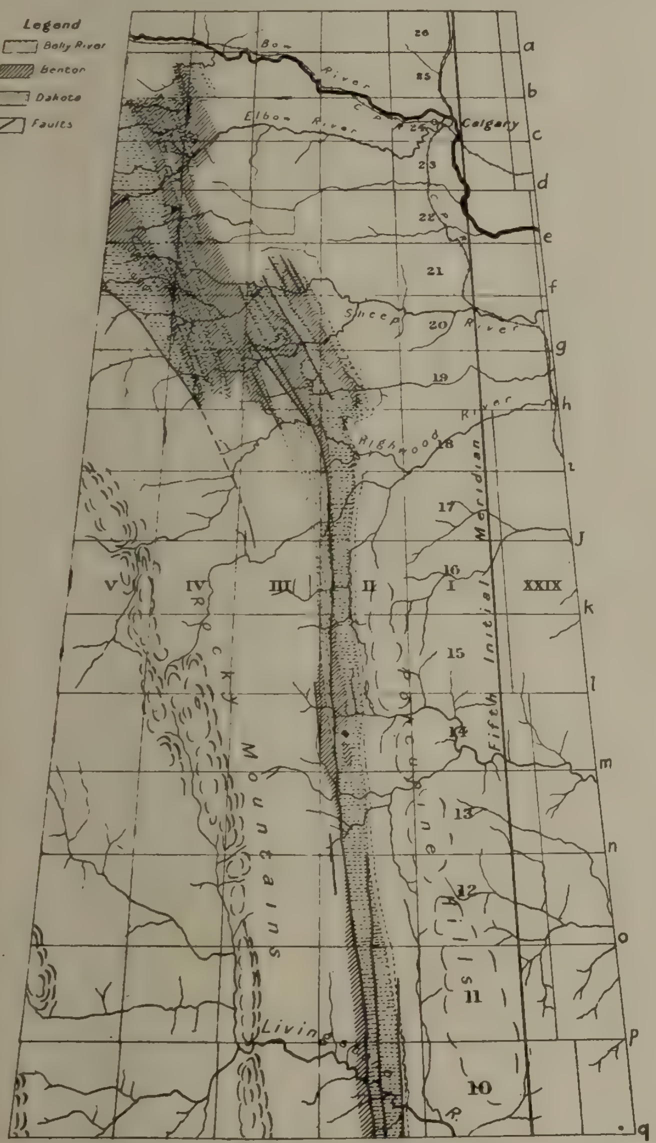

Fig. 1. Perspective diagram, Foothills of Southern Alberta

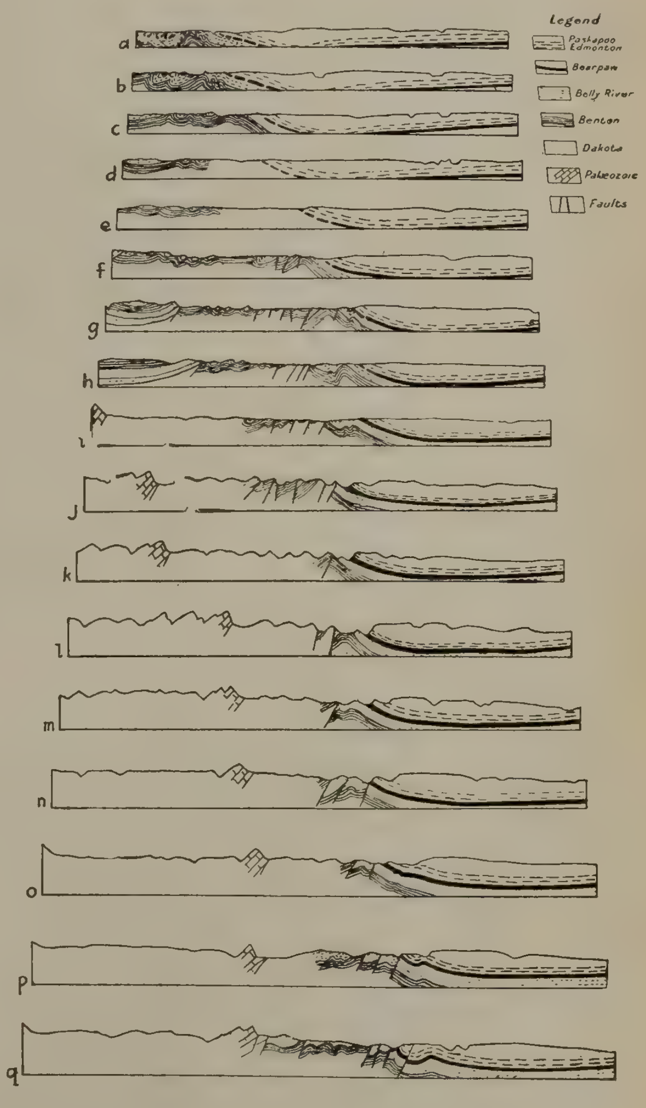

Fig. 2. Structure section, Southern Alberta Oilfields.

*Extracts from a paper to be read at the San Francisco meeting of the American Institute of Mining Engineers, Sept., 1915.

of very light oil. Another in Township 23 west of Elbow River has yielded heavier oil.

In the country to the east of this broken area and the syncline indicated in Figs. 3 and 4, the beds are so slightly flexed that they seem at any one point to be almost horizontal. They are as a rule less consolidated than the beds near the mountains, and the rivers are deeply trenched. This river erosion is accompanied in nearly every case by a series of land slips, extending back for some distance from the banks. This already has been interpreted as faulting by several "experts" and an intricate structure showing anticlines and faults has been pictured providing many "oil companies" with attractive prospectuses. There is a wide anticline, however, in Southern Alberta, between the outer foothills and the Cypress Hills at the eastern boundary of the province, which extends from Northern Montana well into Alberta. This had already been the subject of investigation for a possible natural gas reservoir; and the wells at Bow Island which supply Lethbridge and Calgary are located on it. Attention has again been called to it by the discovery of slight signs of oil in springs on the slopes of the Sweet Grass Hills in Montana, and several drilling rigs have been placed in the valley of Milk River and even at the Boundary line, on the flanks of the above-named hills. The borings in this vicinity will probably penetrate the sandstones of the lower part of the Belly River series, and also the Benton, before reaching the Dakota, from which there seems to be some chance that gas at least will be obtained. The thickness of the Cretaceous measures is here smaller than in the foothills, and very deep wells will not be necessary to test the ground.

A flat anticlinal structure is also indicated by the outcrop of the Belly River rocks in the eastern part of Alberta. This anticline runs in a northwest direction and is crossed by several stream valleys, notably that of the Battle River. The Grand Trunk Pacific Railway crosses the Battle River near the axis of the anticline. A well, sunk for gas near the railway but to the west of the centre of the anticline, struck a small gas reservoir at a depth of 2,340 ft.

Development.—Oil seepages have been known for many years in the mountains along the International boundary east of the Flathead Valley. Several companies bored wells at the outer edge of the mountains, and about six years ago there was some excitement over the discovery of oil in a well near the Waterton lakes. The difficulty of getting machinery to this region and the probability of the area being limited prevented extensive prospecting. The finding of oil last year in an easily accessible area of less broken country at the outer edge of the foothills at once attracted the attention of the speculative element of the population; and many companies were formed and oil leases applied for. The discovery well is situated on an anticline of Benton shales, flanked on both sides by sandstone ridges cut through by the valleys of three streams. Since the sandstone at the crown of the anticline has been removed by denudation, the direction of the anticlinal axis is marked by a series of transverse valleys eroded in the shales. These depressions afford favorable locations for derricks; and 11 wells are now being bored. In the country to the west of this anticline many other drillings are being made so that in the portion of Alberta shown in Figs. 1 and 2 there were during 1914 about 36 separate points of attack, mainly in the foothill belt. Two wells have reached depths of more than 3,000 ft. without success. Seven, including the discovery well, are over 2,000 ft. deep. Fourteen are over 1,000 ft. deep and thirteen others have reached smaller depths.

Three companies are boring in the Milk River Valley and four in the foothills north of Bow River. In a few cases it may be considered that the ground has been found to be barren of productive reservoirs; but in the majority of cases the mechanical difficulties have been so great, owing to the depth to the prospective oil-sands, that no positive result has been reached. In some cases the wells have been badly located from the viewpoint of structure.

In the discovery well, light, gasoline oil and a heavy gas flow were found at 1,550 ft. in sandy beds in the lower Benton. At 2,700 ft. another flow of gas and oil was found in the Dakota or in sands of about that horizon. This oil was also light in specific gravity (about 55 deg. Baume) and was accompanied by a heavy flow of gas which has been shown by experiment to produce a light gasoline on condensation.

It is claimed that showings of oil have been got in several wells in the vicinity.

A discovery of oil 40 deg. Baume in the well of the Moose Mountain Oil Co. was announced on Nov. 24. 1914. The well has since been shot and a yield of 25 bbl. per day is claimed. The oil is dark brown and shows a greenish color by reflected light. It was struck at a depth of 1,690 ft. in the top beds of the Dakota.

In March, 1915, two wells near the discovery well reported oil. The Heron-Elder well, on the western limb of the anticline, reached the top of the Dakota at 2,746 ft. Oil came into the well at 2,774 ft. and rose about 2,000 ft. The oil is dark in color and probably heavier than that from the discovery well. About a mile south and near the crest of the anticline the Western Pacific well reached the top of the Dakota at 2,150 ft. and report gives about 300 ft. of oil in the well accompanied by a strong gas pressure.

LASSEN IS AN ACTIVE VOLCANO.

The latest reported outbreak of Lassen Peak, California, marks a distinct point in the progressive change in the character of the eruption and places Lassen, in the category of sure enough, more or less dangerous, volcanoes. Heretofore the eruptions have carried only bowlders and light ashes as black smoke without illumination. The present eruption is reported as involving genuine lava whose cloud-reflected glow reminds one of Stromboli, the active volcanic lighthouse of the Mediterranean. J. S. Diller of the United States Geological Survey has just received a telegram from J. R. Milford, Superintendent of the Northern California Power Co., at Redding, California, dated May 20, stating that:

"Lassen Peak in violent eruption 9.30 to 11.30 last night. Fire observed coming from crater. Incandescent ejecta roll down the mountain side. I observed spectacle from Volta (10 miles from Lassen Peak). Many in Sacramento Valley saw same. At Manzanita Lake (3 miles from the crator) to-day storm clouds prevented complete observation. Activity immensely increased."

The present eruption means, according to Mr. Diller, that the explosions are getting down into real hot stuff and that the activity is more completely volcanic. Heretofore the ejected fragments blown out by the steam explosions were rarely ever red hot. Vulcan is evidently on the job and giving a most attractive exhibit for the Panama-Pacific Exposition.

FIELD OPERATIONS OF THE GEOLOGICAL SURVEY IN 1915

In the Maritime Provinces.

The Geological Survey is placing several parties in the field to carry on geological investigations in the Maritime Provinces during the summer of 1915. The economic possibilities of a number of districts will receive attention.

Mr. E. R. Faribault, who has made a special study of the gold-bearing series of Nova Scotia, will continue the geological mapping of this series in Queens and Shelburne counties.

The geological mapping of the vicinity of St. John, New Brunswick, will be completed by Dr. A. O. Hayes. Dr. Hayes will make an examination also of the productive coal measures of New Glasgow, Nova Scotia, and vicinity, and will commence the detailed mapping of this area on a scale of 200 ft. to 1 in.

Mr. W. J. Wright will complete the work for the geological map of the Moncton area and will continue his studies of the oil-bearing shales of the railway belt between Moncton and St. John.

Under the supervision of Dr. L. Reinecke an investigation will be made in southern New Brunswick of materials suitable for road metal and the locations of these will be indicated on maps.

Mr. C. L. Cumming will continue his examination of the igneous rocks of the vicinity of St. John; Mr. W. A. Bell will carry on palaeobotanical studies near New Glasgow, N.S., and some localities in Nova Scotia will be visited by Dr. E. M. Kindle, the invertebrate palaeontologist.

In Ontario and Quebec.

The Geological Survey is continuing its geological investigations in Ontario and Quebec during the summer of 1915 by placing a number of parties in the field in each province. Studies of the economic possibilities of the better known sections will be carried on, and exploratory work will be conducted in the more remote sections.

An investigation of the asbestos deposits will be conducted by Dr. R. Harris, who will map the country in the vicinity of Thetford Mines on a scale of 1 mile to 1 inch.

Dr. M. E. Wilson will continue the geological examination of the Buckingham area, paying particular attention to the deposits of mica, graphite and apatite. Mineralogical investigations in the neighborhood of Templeton will also be carried on by Dr. Auguste Ledoux.

An investigation of the mineral and other natural resources of the Lake St. John region will be conducted by Mr. J. A. Dresser. This will include the Palaeozoic basin surrounding the lake and the deposits of iron ore in the region to the east. Dr. J. A. Bancroft will complete the examination of Mount Royal tunnel.

Exploratory work will be carried on to the south and east of James Bay. Dr. H. C. Cooke will make a geological reconnaissance of the Waswanipi river basin, and Mr. T. L. Tanton will continue the reconnaissance of the Harricanaw river, special attention in both cases being given to areas of economic importance. A survey of the east coast of James Bay will be made by Mr. W. E. Lawson, of the Topographic Division.

Ornithological investigations will be carried on by Mr. P. A. Taverner. Perce will be again visited, and about a month will be spent on Magdalen islands during the bird migrations. A visit will probably be paid to Anticosti island and the north shore of the Gulf of St. Lawrence, where work will be done in conjunction with Dr. Charles Townsend, who is making an intensive study of the ornithology of Labrador and the north shore of the Gulf.

Dr. W. H. Collins will continue his work on the correlation of the pre-Cambrian formations north of Lake Huron, and will start the areal mapping of the Sudbury district and an investigation of the nickel-copper deposits.

The study of the silurian formations of southwestern Ontario and Manitoulin island will be continued by Dr. M. Y. Williams.

Mr. W. A. Johnston will complete the mapping of the Orillia, Brechin, Kirkfield, Beaverton, Sutton and Barrie sheets, after which he will carry on special soil surveys in the district about Ottawa. Soil surveying, which includes the classification and mapping of the surface soils, is a new activity of the Geological Survey, and the resulting maps and reports will be great aids to the agriculturist seeking allotments of land and to the Government in securing the utilization of different classes of land to the best advantage.

A study of the pleistocene geology in southwestern Ontario, between London and Lake Erie, will be undertaken by Mr. J. Stansfield, who will give special attention to such economic deposits as clays, sand and gravel, road metal, building stone and materials for lime and cement.

Triangulation of the Sudbury district will be done by Mr. S. C. McLean, and a topographic map of the same district will be made by Mr. E. E. Freeland.

The economic possibilities of certain clay and shale deposits in both provinces will be examined by Mr. J. Keele, and their suitability for the manufacture of structural material, paving brick, sewer pipe, etc., investigated.

Dr. L. Reinecke will study and map materials suitable for road metals between Ottawa and Prescott and south of Montreal. This work is of very great importance in connection with the construction of better highways.

Mr. F. H. S. Knowles will carry on studies in physical anthropology among the Iroquois Indians.

Archaeological investigations will be conducted in Ontario. Mr. W. J. Wintemberg will continue the excavation of the old Indian village site at Roebuck, Grenville county, after which an examination will be made of certain prehistoric mounds on the north shore of Lake Ontario.

In Western Canada.

Field operations by the Geological Survey will be continued in western Canada during the summer of 1915, and particular attention will be given to our economic resources in minerals, both metallic and non-metallic.

Dr. E. L. Bruce will continue his investigations of the ore deposits of Amisk (Beaver) Lake district in northern Manitoba and Saskatchewan, and Mr. A. McLean will complete the mapping of the Pembina Mountain area near the U. S. boundary.

A geological exploration of the Churchill River area from South Indian lake to Hudson bay will be made by Mr. F. J. Alcock.

Mr. Charles Camsell will examine the geology at the east end of Lake Athabaska and look into the reported occurrence of silver at Fon du Lac. The latter part of the season will probably be spent by Mr. Camsell in making an exploration of the region traversed by the

Grand Trunk Pacific Railway between Fort George and Telkwa.

Mr. S. E. Slipper, in addition to completing the geological field work for the special map of the Sheep Creek area, Alberta, will make an investigation of the underground waters of an area in southern Alberta in the vicinity of Lethbridge, and will continue the collection of boring records in the oil and gas areas.

Further investigations into the coal resources of the western provinces and of the oil prospects will be made by Mr. D. B. Dowling.

Dr. Bruce Rose will study the geology of the Flathead and Crowsnest coal areas, mapping the productive coal measures and inquiring into the prospects for oil. An examination will also be made by Mr. F. H. McLean of sections of the Benton, Kootenay, Fernie and Blairmore formations of these areas, and fossils will be collected. Mr. J. S. Stewart will also have charge of a party under Dr. Rose's supervision studying the structure of the disturbed belt of the foot-hills south of the Oldman river.

Dr. S. J. Schofield, after completing the investigation of the silver-lead and zinc deposits of Ainsworth and the geological mapping of the country between Kootenay lake and Cranbrook, will start mapping the geology of the Windermere area.

Mr. O. E. Le Roy will be occupied with work entailed by his appointment as a member of the commission named to investigate the iron resources of Canada. Should time permit the mapping of the Slocan area will be completed.

Dr. C. W. Drysdale will map the Lillooet area on a scale of 2 miles to 1 inch and make an examination of the ore deposits.

Mr. J. D. McKenzie will study the geology of the Hazelton-Aldermere area, paying particular attention to mineral deposits.

A geological examination of an area on Stewart river, Yukon, will be made by Dr. D. D. Cairnes, special examinations being made of the gold-bearing quartz in Dublin gulch, McQuestion river, and of silver-lead deposits in the vicinity of Mayo lake.

Dr. E. M. Kindle will carry on stratigraphical and palaeontological investigations in Rocky Mountain park, and Mr. E. L. Burling will examine geological sections along the main lines of the Canadian Pacific and Grand Trunk Pacific Railways.

Mr. C. H. Sternberg will collect dinosaurian and other reptilian remains from the vicinity of the Canadian portions of Milk river and its tributaries, and will explore this region to locate the most promising areas for fossil collecting. Mr. Geo. F. Sternberg will collect reptilian remains from the Edmonton formation on Red Deer river. Both of these parties will also make careful search for fossils of primitive mammals.

Topographical work will be carried on at a number of points. Mr. B. R. McKay will complete the survey of Lake Athabaska; Mr. C. H. Freeman will complete the map of the Sheep Creek section of Alberta; Mr. S. C. McLean will carry on triangulation in coal areas of the Rocky mountains; Mr. D. A. Nichols will make a topographic map of the coal area of Highwood river; Mr. F. S. Falconer will continue the mapping of the district to the north of Revelstoke, and Mr. A. G. Haultain will make a topographic map of the Mayo district, Stewart river, Yukon.

Professor John Macoun and James Macoun will conduct botanical investigations on the islands in the Gulf of Georgia and on the east side of Vancouver island.

Mr. J. A. Teit will make ethnological studies among the Athabaskan tribes of northern British Columbia. Mr. Christian Leden is collecting anthropological specimens among the Eskimos of the west coast of Hudson bay.

Archaeological investigations will be carried on by Mr. H. I. Smith in the vicinity of Fort Fraser and Hazelton on the Grand Trunk Pacific Railway, and by Mr. W. B. Nickerson in Manitoba.

MINING IN NORTHERN BRITISH COLUMBIA.

The sixth annual report of the Board of Trade of Prince Rupert, British Columbia, has been published in pamphlet form. It contains much information relative to activities of the board and the industries and progress of the sea-port city the large area of country for which it is the chief distributing place. In a sense, though, the report is misleading; not that there is any improper attempt at deception, but that the proportion of the immense area of territory that may correctly be designated "Northern British Columbia" included within the scope of the commendable efforts of the board is comparatively small. That this is so may be at once recognized if a map of the province be taken and the extent of the country included in the board's review be compared with the large area of Northern British Columbia as a whole. However, allowance may be made for the natural enthusiasm and optimism that seem to characterize the members of the Prince Rupert Board of Trade responsible for the publication of the pamphlet above referred to, for their home sea-port city is certainly the most populous and important commercial and industrial centre in the British Columbia coast north of Vancouver, which probably accounts for the failure to keep in mind that years before the city of Prince Rupert was thought of gold-mining was important much farther north in British Columbia, the total value of the output of gold from Atlin mining division alone having to date exceeded $6,000,000.

Concerning mining in the district tributary to Prince Rupert, the board's sixth annual report which was presented last January, says:

"Steady progress in development work has been the feature of 1914, although the existing crises have considerably retarded further growth in development. The outstanding feature of the war has been the blowing in of the smeltery at Anyox and the consequent completion of the development part of the work undertaken by the Granby Consolidated Mining, Smelting, and Power Co., Ltd. This company expended close on $3,000,000 in purchasing and developing its mines at Hidden Creek and in building and equipping its smelting works at Anyox. The quantity of ore developed is estimated at 12,000,000 tons containing 2.2 per cent. of copper with a small additional value in gold and silver. At 14 1/2 cents a lb. for copper the gross production from this mine will amount to $78,000,000. It is probable that about 75 per cent. of the gross value will be spent for labor and supplies, and it is certain that a large proportion of this amount will find its way to Prince Rupert.

"In the Hazelton district development work has proceeded steadily and several of the mines in that district are beginning to show up very favorably. Proved mines have been made of several prospects and others are in a fair way to prove that they are worthy of taking a place among the producing mines of British Columbia.

"In other districts there has also been a certain amount of work done. Of these districts Portland Canal is worthy of mention on account of the tunnel driven by the Portland Canal Tunnels, Ltd., of Victoria, which has proceeded far enough to show that the work and money spent on this enterprise has been justified. The Omineca district, owing to rumors of a projected railway, has had considerable attention paid to it, in connection with hydraulic leases.

"There are not any new developments in the several coal fields of Northern British Columbia. Most of these districts will take considerable time to develop.

"Considering financial conditions, which are always a large factor in governing development work in mining areas, Northern British Columbia from a mining point of view is showing a steady improvement in its position, and it is a matter of satisfaction to be able to say that there is no doubt that eventually Prince Rupert will become one of the recognized mining centres of British Columbia."

U. S. BRASS MILLS ARE ABSORBING COPPER.

The extraordinary efforts being put forth by the brass mills of the United States to expedite deliveries on big orders received for account of foreign countries, have commenced to be reflected in clearances from American ports. Figures show that all previous records have been broken, particularly in the exportation of bars, plates and sheets.

Furthermore, those sceptics who have been unable to reconcile extremely heavy copper sales with small exports of the metal, even after making allowances for the fact that Germany has taken no copper since last August, will find partial answer in data concerning our exports for the month of March just at hand.

In that month exports of brass, including scrap and manufactured bars and plates, amounted to 11,772,727 lb., against 7,624,026 lb. in the preceding month and 3,363,089 lb. a year ago. During the nine months ended with March, covering the period to date, exportations of brass in all forms amounted to 35,747,415 lb., against 23,270,975 lb. in the same period of the preceding year.

The significance of the growth in these shipments was not so much in the total of 36,000,000 lb. as in the fact that an 18,000,000 lb. gain was recorded in the shipment of finished brass as bars, plates and sheets. Heretofore the principal form of brass exports has been as scrap fit only for remanufacture.

Comparative figures are appended:

Brass exports (lb.)	1915.	1914
January	5,216,028	2,776,661
February	8,624,026	2,547,250
March	11,772,727	3,363,089

Nine months (lb.)—	1915.	1914.	1913.
Scrap and old	12,795,716	19,108,419	13,503,640
Bars, plates etc.	22,952,699	4,162,556	5,792,543
Total	35,747,415	23,270,975	19,296,183
*Total value	$8,727,397	$5,691,280	$6,330,264

*Includes articles made from brass in addition to scrap and bars.

As brass constitutes 75 per cent. copper and 25 per cent. spelter, the relation of these figures to the copper industry may be readily seen.

Exports of copper in March, according to the Government returns, amounted to 66,583,350 lb., against 96,519,947 lb. last year. Up to March 31 there had been exported in the fiscal period 508,369,337 lb., against 728,767,917 lb. In the period under review, however, shipments to Germany had dropped to 22,253,505 lb., whereas in the previous like period there had been exported to that country 239,919,180 lb. Consignments to Holland, chiefly for German consumption, also fell off heavily, the total being but 30,589,939 lb., against 128,374,858 lb.

With brass mills doubling their capacity in this country and every one of these plants now running three 8-hour shifts, copper is being consumed as never before, and with enlarged capacity will soon be in position to handle a greater tonnage of the metal than ever before in our history. —Boston News Bureau.

The introduction of the tube mill in 1904 had much to do with the development of heavy stamps. Until that time fine crushing in the battery was necessary, in order to secure good recovery by amalgamation and cyaniding; but with the advent of the tube mill it became possible to use screens of coarser mesh, the limiting factor being the coarseness permissible for good amalgamation. It was obvious, therefore, that if battery amalgamation plates could be dispensed with, the only factor limiting coarse crushing would be the size of particles permissible in the tube-mill circuit. The removal of battery plates was therefore the next step toward attaining maximum stamp duties; and now in all the newest mills amalgamation is only carried on after tube milling. We thus find the function and scope of the stamp quite altered; it is now recognized as a crushing device pure and simple, hampered in capacity by tube-mill limitations only; so that, beginning with duties of a few tons from 900-lb. stamps when screens of 900 mesh were necessary, we are now obtaining duties of approximately 30 tons, with 9-mesh screens (0.27 in. aperture) from 2,000-lb. stamps. There is still, however, a considerable range in weight and duty of stamps on the Rand. Many older plants still retain battery plates, and are not provided with the same tube mill facilities as newer mills. This is because capital expenditure on old plants is not always warranted by the life of the mine and the financial position of the company.

Mills on the properties of other groups are obtaining stamp duties as high as 20 tons per day, from 2,000-lb. stamps, with 9-mesh and 4-mesh screens; but the highest duty yet recorded is that of the 2,000-lb. Nissen stamps at Modderfontein B., 29 tons through 9-mesh screen.

EXPLOSION-PROOF MOTORS.

Among its investigations dealing with the means of lessening such dangers as attend the use of electricity in the mining industries, the U. S. Bureau of Mines has undertaken one that has for its purpose the establishment of permissible explosion-proof motors for use in places where an electric spark or flash might ignite inflammable gases or dusts.

Technical Paper 101, "Permissible explosion-proof Electric Motors for Mines; Conditions and Requirements for Test and Approval," which has just been issued, mentions the details of construction that the bureau considers essential for satisfactory service, and describes tests of an explosion-proof mining machine motor and its accessories approved by the bureau. The author of the paper is H. H. Clark, electrical engineer.

The U. S. Bureau of Mines has applied the term "Explosion-proof" to motors constructed so as to prevent the ignition of gas surrounding the motor by any sparks, flashes or explosions of gas or of gas and coal dust that may occur within the motor casing.

Before it undertook to establish a list of permissible motors the bureau made a large number of preliminary tests. No motors were approved as a result of this preliminary investigation, for none of the motors tested was considered to possess the characteristics of permissibility. As a direct result of these preliminary tests, however, the bureau decided to make tests to establish a list of permissible explosion-proof motors, and issued its Schedule 2, "Fees for Testing Explosion-proof Motors." This schedule gave the general conditions under which motors could be submitted for test and the fees to be charged for making such tests. Technical Paper 101 sets forth more fully than Schedule 2, the details that the bureau considers essential to satisfactory explosion-proof motor construction.

The Bureau of Mines considers a motor to be permissible when it is the same in all respects as the sample motor that passed certain tests made by the bureau and when it is installed and used in accordance with the conditions prescribed by the bureau.

The paper gives the requirements for approval of motors, outlines the nature of the approval of the bureau and describes the approval of an explosion-proof coal-cutting equipment.

A PRIMER ON EXPLOSIVES

The United States Bureau of Mines, several years ago, issued a primer on explosives for coal miners which has been in considerable demand ever since.

Now the bureau has issued a primer on explosives for metal miners and quarrymen, by Charles E. Munroe and Clarence Hall. The bulletin, which has just come from the printing office, says in its introduction; "In accidents resulting from the use of explosives in metal mines and quarries in the United States more than 130 men were killed and 250 seriously injured during the calendar year 1913. Moreover, an unknown number of miners suffered from the effects of breathing the harmful fumes and gases given off by the burning or the incomplete explosion of some explosive. Consequently, the Federal Bureau of Mines, which is endeavoring to increase safety in mines and to abolish conditions that tend to impair the health of miners, is studying the kinds of explosives used in mining and the conditions under which these explosives can be used with least danger to the miner.

"Inflammable gas or dust is seldom, if ever, found in quarries or metal mines, and the danger from using explosives there is less than in coal mines; but, as the figures show, the number of men killed and injured yearly in accidents caused by explosives prove the need of both miners and mine officials striving to see that none but proper explosives are used and that these are used properly."

The bulletin contains chapters on combustion and explosion; blasting and mine explosives; fuse, detonators, and electric detonators, firing blasts by electricity; the use of explosives in excavation work; the use of explosives in quarrying; the use of explosives in metal mining and tunneling; drilling and blasting methods on New York rapid-transit tunnel; magazines and thaw houses; permissible explosives, etc.

This publication is Bulletin 80 and it may be obtained free of charge by those interested writing to the Director of the Bureau of Mines, Washington, D. C.

The Third Annual Joint Field Meet of the United States Bureau of Mines, the American Mine Safety Association and the California Metal Producers Association will be held at the Panama-Pacific Exposition September 23 and 24. It is expected that there will be a large attendance of mining men, as the joint meet will either precede or follow the annual meetings of a number of institutions allied to the mining interests, such as the American Institute of Mining Engineers, September 17 and 18; The International Engineering Congress, September 20 to 25; the American Mining Congress, September 20 to 22; the California State Mine Rescue and First Aid Contest, September 22; and the National Safety Conference, under the joint auspices of the National Safety Council and the California Industrial Accidents Commission, September 27 to 30.

On September 23, on the athletic field of the Panama-Pacific International Exposition, there will be a mine-rescue demonstration at 10 o'clock; at 2 o'clock in the afternoon there will be a first-aid demonstration; and at 4 o'clock a demonstration of the explosibility of coal dust.

On September 24, at 10 o'clock, will be held a first-aid contest for inter-state supremacy; at 2 in the afternoon a rescue contest for inter-state supremacy; at 4 in the afternoon a rock drilling contest; and at 8 o'clock in the evening, there will be an award of prizes and souvenirs at the Convention Hall.

The establishment of a plant for copper refining will likely take place, following a conference between the Minister of Militia, General Hughes, the chairman of the Shell Committee, Col. Bertram, Col. Carnegie, Dr. Wilson of the Department of Mines, Messrs. W. D. Matthews and Warren of Toronto. It is intended to have every part of the shells which Canada is supplying made in Canada, and as far as possible of Canadian products. According to a despatch from Ottawa the refining of copper in Canada is now considered probable, and the plant will in all probability be located in New Ontario. Canada is now turning out 30,000 shells a day, and Canadian factories are making high explosives as well as shrapnel shells. A very large amount of Canadian lead has been used in the manufacture of munitions for the British army.

The Railway Age Gazette announces that Russia has placed orders for 22,000 cars with concerns in Canada and the United States, divided as follows:

Pressed Steel Car Co., 7,000 cars, Seattle Car & Foundry Co., 7,000, Eastern Car Co. of Canada, 2,000, Nova Scotia Car Co., 2,000, American Car & Foundry Co., 2,000 and Canadian Car & Foundry Co., 2,000.

All of the cars, except those bought from the Seattle concern, will be the regulation two-truck cars; but those built in Seattle will be four-wheeled carriers. purposes.

"Central Station Power in Coal Mines" is the title of a pamphlet just issued by the Westinghouse Electric & Mfg. Co. This pamphlet deals with the subject of electric power for coal mines and shows the advantages to be gained by the operator from using power from central station plants. A number of tables are given showing the cost of operation; curves are also given showing the day and night load in the mine.

METALLURGICAL PRACTICE ON THE WITWATERSRAND

By F. L. Bosqui

(Continued from last issue)

Classification.

The necessity of providing a specially thickened and classified pulp for tube mills gave fresh impetus to the study of classification, which hitherto had been chiefly confined to the rather crude methods in vogue of separating sand from slime. The earliest classifiers were of the inverted pyramid type, a first series of spitzlutten with small pockets being designed to eliminate the coarse sand and concentrate, which were collected and given a special treatment, and a second series of much larger pockets being used for separating sand and slime. A further separation of sand and slime took place in the sand collectors, the overflow of which passed to a series of return-sand spitzkasten for the further elimination of sand, the final overflow product from the latter going to the slime plant.

When tube mills were introduced in 1904, the coarse product was no longer separately collected but run to these mills; and the apparatus for classification gradually took the form of a simple series of spitzkasten, provided with underflow nozzels of different apertures. This underflow passed to the tube mills, while the overflow went direct to the sand collectors, in which the slime was separated from the sand and discharged by means of adjustable overflow weirs into so-called return-sand classifiers, which in turn discharged their overflow to the slime plant.

The first step in the much-needed improvement in classification was taken in 1908, when Messrs. Caldecott and Smart developed what is known as the diaphragm cone, now generally employed for thickening and classifying tube-mill pulp. This consists of a sheet steel cone, 5 to 6 ft. in diameter and 7 to 9 ft. deep, provided near the apex with an iron disk or diaphragm. This disk is 8 to 10 in. in diameter, and the annular space between it and the sides of the cone is 2 to 2½ in.

The proper action of this diaphragm is obtained only when the cone is full of solids. The mass of sand in the cone then assumes a concave surface, the deepest point from the plane of the overflow edge being immediately under the central pulp inflow. At this point, where the coarsest and heaviest product accumulates, the surface is seen to be in a state of slow continuous subsidence. This slowly subsiding mass of heavy material, conceivably irregular or conical in shape, may be presumed to act as a descending wedge, retarded in its downward course by the supporting diaphragm; while the finer sand, with the slime, tending to adhere to the sides of the cone, would appear to be literally pushed aside and crowded upward by the central column, so reaching the overflow rim and escaping. The slow, thick stream issuing from the apex carries only from 26 to 30 per cent. moisture, and a minimum of the fines which it is desirable to exclude from the tube mill.

These cones have a large capacity, and, barring the one disadvantage of vertical height required, may be considered the most simple and suitable means yet devised for providing all the conditions requisite for a tube-mill feed that will enable the mill to work at highest efficiency. This device is now used either as the sole means of classifying mill pulp, or in conjunction with hydraulic classifying cones. An important aspect of this innovation was its having made possible the introduction, in 1907, of the Caldecott sand-filter table; a device whose success obviously depended upon securing a suitable thickened pulp, containing a small amount of water and a minimum of slime. The primary object of this appliance, as explained by the inventor, was to obtain sand in such a condition for treatment as would warrant the elimination of sand-collecting vats, which could then be used for treatment purposes. Obviously, the effect of this was to increase very considerably the capacity of a leaching plant.

Single treatment of sand—Metallurgically considered, however, the significant feature of this appliance was its revival of the old question of the possibility of single treatment of sand after proper classification. In this connection it is interesting to note a prediction made by Charles Butters in 1895, that "the whole question of double treatment really resolved itself into a matter of filling the vats with clean stuff, and he was confident that the day would come when there would be no double treatment." The first notable success in America in collecting and treating sand in the same vat was at the Homestake mill; but in Africa, with the single exception of the East Rand Proprietary, double treatment has been retained until quite recently.

In 1910, when the new plant for the Modderfontein B. mine was being designed, I undertook to evolve a simpler method than the filter table for obtaining a clean sand, with a view to the subsequent elimination of separate collecting tanks. This classifying plant consists of eight small primary hydraulic cones, 2 ft. 9 in. in diameter and 2 ft. 6 in deep designed as concentrators for insufficiently ground sand particles from the tube mills. The overflow from these gravitates to four larger hydraulic cones, 8 ft. in diameter by 6 ft. 9 in. deep, which effect a very satisfactory separation of sand from slime, the overflow gravitating direct to the slime collectors. The underflow of the large cones is evenly distributed in the collectors by the Butters and Mein distributor, a device recently revived on the Rand Mines group after several years of disuse.

This system, in view of the possibility of treating a considerable amount of fine (—200) sand in the Butters filter, was found to be well adapted to this mode of filtration, the correct proportion of fine sand and slime being easily obtainable. Moreover, an evenly distributed sand charge was secured, free from lumps and layers of slime. This system has been adopted by other mines of the Rand Mines group; and in newer plants has, with a few modifications, superseded the primitive method of charging sand and slime together into collectors and depending upon a Kaffir and a movable hose for even distribution.

At the Crown Mines, an improved hydraulic attachment for cone classifiers was devised by H. Brazier, the reduction foreman at "C" mill. This consists of an adjustable nozzle for discharging water in proximity to the apex of the classifying cone in the form of a thin circular sheet, directed horizontally between the nozzle and the cone. By means of this system of cone separators, the classification of sand is

permissible within a wide range, and has enabled us to obtain a charge of sand so permeable and uniform that after practical trials the separate sand collector is now recognized to be superfluous, and will be omitted in forthcoming plants to be erected by the Rand Mines group.

We have then at the present time on the Rand two very satisfactory methods for classifying sand: (1) the Caldecott sand-filter table, and (2) the system of hydraulic cones just described. The former possesses the advantage of delivering a solution-borne sand to the treatment tank, and so shortening the time of treatment and increasing the capacity of existing plants, which is a very desirable thing, especially where the saving of capital outlay is imperative, as at the City & Suburban, where the sand-filter table obviated an expensive and awkward extension of plant. But for new mills adopting single treatment of sand, the indirect saving in sand plant would appear to be offset by the lower initial expense of the hydraulic-cone system itself, the small amount of attention required, and its negligible cost of maintenance and operation, as compared with the filter table.

Treatment by Cyanide.

It was only after the introduction of the cyanide process that the distinctive terms "sand" and "slime" came into common use. In the early days of cyaniding the bugbear was slime, or the unleachable, finely divided portion of the mill pulp, which the mill man endeavored to avoid making, in order to secure as large a proportion as possible of leachable sand. Until a method of treating slime was devised, this product was impounded in dams; these accumulations have been for the most part treated.

When the decantation process made it possible to deal with current slime direct from the stamp mill, the production of the latter was no longer avoided. Until vacuum filtration was introduced, the slime represented between 30 and 40 per cent. of the total product of crushing; but this proportion has gradually increased with the progressive improvements in treatment, until now as high as 60 per cent. of the pulp is treated as slime. We may say, therefore, that tube mills, improved classification, and the vacuum filter have made possible (1) the treatment of a greater proportion of slime than formerly, which has improved the total extraction, and reduced the cost of treatment, since slime can be more cheaply treated than sand, and (2) the treatment of more finely crushed sand, with consequent improvement in extraction. In the best plants, a recovery of 90 per cent. of the gold from sand and 93 per cent. from slime is now being obtained, or a total recovery of 96 per cent., which is probably the highest extraction economically attainable on the Rand. The metallurgist in Johannesburg to-day is therefore chiefly concerned with those improvements in appliances, general technique, and administration, which, in view of the much reduced grade of ore, will minimize cost of treatment.

Treatment of Sand.

The treatment of the sand by leaching with cyanide solution in steel tanks, ranging in size between 45 and 56 ft. in diameter, is still the accepted practice. In the early days an attempt was made to collect and treat sand in the same tank, but an inperfect knowledge of classification, or a failure to recognize its importance, made this scheme impracticable. Until very recently, the prevailing practice was to collect the sand in a series of tanks, known as "collectors," from which it was shoveled out by natives and transferred to the treatment tanks. The majority of plants were built with the collector superimposed on the treatment tank, but this arrangement was finally superseded by the erection of collectors and treatment tanks on the same level, the transference of sand from one to the other being by means, first, of trucks, and later, by belt conveyor. The latter was supposed to be cheaper in first cost, as it eliminated the expensive steel superstructure for supporting the enormous weight of superimposed tanks, and also reduced the height of pulp elevation. But it would appear now, after a pretty thorough experience with both systems, that, as regards first cost, the superimposed system has a slight advantage; while owing to the rapid disintegration of conveyor belts in the dry atmosphere of the Rand, and the considerable maintenance cost of conveyor systems in general, the superimposed tanks are less expensive to operate, in spite of the higher pulp lift required.

Methods of collecting sand—At the present time there is still considerable variation in the modes of collecting sand. The following methods are in use:

1. In the older plants all the mill pulp is run into a collector, through a rubber hose 4 to 6 in. in diameter, manipulated by a Kaffir who moves about in the tank changing the position of discharge to prevent undue slime accumulations; the slime and water, with varying proportions of fine sand, overflow through discharge gates provided with an adjustable canvas blind, which is raised to suit the overflow as the tank fills.

2. The total mill pulp is distributed to the collector by means of a peripheral launder provided with outlets; the water and slime overflow through an adjustable opening at the center.

3. The sand is classified and thickened in diaphragm cones, dewatered on a sand-filter table, and delivered in cyanide solution either to a collecting or treatment tank by means of a Butters and Mein distributor.

4. The sand is classified in hydraulic cones and delivered in water to a collecting tank by means of a Butters and Mein distributor; in one plant the sand will go direct to the treatment tank.

It was formerly customary in some plants to give the sand a preliminary treatment with a weak cyanide solution in the collectors; this practice has now been generally abandoned, and the only operation that takes place in the collector is the forced drainage of the charge by means of pumps, thus reducing the moisture to about 14 per cent. The sand is discharged from the collectors by (1) hand shoveling through discharge doors into treatment tanks or to belt conveyors; (2) by means of the Blaisdell excavator. The high capital outlay required for the latter, without compensating economy in operation, has led to the retention in newer plants of the older system of hand shoveling by natives. All plants using a belt conveyor from collectors to treatment tanks have, however, retained the excellent Blaisdell distributing mechanism for distributing the sand in the treatment tank.

The system of applying cyanide solution to the sand does not differ essentially from practice elsewhere, and need not be particularized here. The standard strength of strong solution used ranges between 0.10 and 0.25 per cent., depending upon local conditions, the tendency in recent years being to use weaker solutions than formerly. From 6 to 8 days' contact is usually allowed in the treatment tanks, and about 2 parts of solution to 1 of ore is the average quantity required for leaching purposes.

The methods in vogue of disposing of the residue are by hand shoveling or excavation with the Blaisdell machine into (1) trucks, (2) Bleichert aerial con-

veyor, or (3) belt conveyor. The second method is used at only one property, the Brakpan mines, where it is reported to be giving satisfaction; the third method is used on two mines, but whatever advantages it may possess have not been generally recognized; while the first method, namely, truck haulage by surface cable, is in general use. It is considered the cheapest, most flexible, and best adapted to local conditions, and will probably continue to be the favorite means of disposing of sand residue.

Treatment of Slime.

Since 1894, the continuous treatment of slime by the so-called decantation method has meant the recovery of over 80 per cent. of the gold from a very considerable portion of the total ore crushed, and has been retained by the majority of operating mines. In most cases, however, it has been retained, not because its limitations have not been recognized, but because possible improvements in recovery do not always justify the sacrifice of capital involved in replacing old plants with new, especially on mines of short remaining life.

The technique of decantation, which is well described in several technical works, need only be briefly touched upon here. The slime pulp from the classifiers is settled in what are known as collectors, large cone-bottom tanks, provided with an overflow rim and adjustable decanter, in which the slime settles to the bottom, the water escaping at the overflow rim. The settled slime charge after decantation, containing approximately 50 per cent. of moisture, is then sluiced out with a weak cyanide solution into the intake of a centrifugal pump connected with the centre of the cone bottom, and transferred to another tank, known as the "first settlement tank." Here the charge is kept in circulation by means of a pump, then allowed to settle, as in the collector, and the gold-bearing solution is decanted off to the zinc boxes. This decanted charge is again transferred, subjected to a similar settling and decantation in a "second settlement vat," and finally discharged to the dam with water or a very dilute precipitated solution. Settlement in these tanks is hastened by the use of lime, which is applied in a variety of ways, being either periodically fed to the stamps or tube mills, or to the slime pulp in slaked form, by means of feed hoppers, or as milk of lime from a grinding pan.

The limitations of decantation are obvious: The displacement of the dissolved gold is only practicable within certain economic limits, so that a certain definite gold loss in the final discharge to the dam must always be reckoned on. This loss is necessarily variable, depending upon capacity, difficulties in settlement, and general design of plant. On the other hand, the process is simple and comparatively inexpensive in operation, and, in spite of the losses through imperfect washing, is peculiarly applicable to the low-grade slime of the Rand. Even the advocates of more exact and positive methods of treatment must admit that in the latest and best designed decantation plants, in which large capacity is allowed for settlement and dilution, and all other conditions are favorable, the margin between results so obtained and the net results of filtration is not a wide one.

The first important innovation in slime treatment was the introduction of the Butters vacuum filter in 1910. The essential features of this device are too well known to require description here. There was from the first no question as to the additional recovery obtainable by the filter; the doubtful point was whether the cost of operation would offset the gain in recovery to the extent of nullifying its advantages. This, however, has not proved to be the case. The prevailing cost of operating the filter on the Rand is from 2½d. (5c.) to 4d. (8c.) per ton of slime filtered, depending upon tonnage treated; and the additional gold recovered ranges from 6d. (12c.) to 2s. (48c.) per ton, depending upon the efficiency of the decantation plants superseded by the filter.

The vacuum filter is now generally admitted to be applicable in the following cases: (1) Where it is desirable to extend a decantation plant of inadequate capacity or obsolete design; (2) where difficulties in settlement make it impracticable to use decantation without prohibitive extension of plant; (3) in all new plants. The most notable instances of (2) were the case of the Randfontein Central mill, where a comparatively new decantation plant treating 2,000 tons of slime per day was replaced by a Butters filter, resulting in a considerably increased recovery of dissolved gold; and the case of the Robinson Gold Mining Co., where the expenditure of £32,000 in 1911, on filter and Pachuca agitators, resulted in an increased net profit of £2,500 per month.

The slime treatment in the modern plants consists in settling the slime in the same type of settlers as is used in decantation, namely, in tanks as large as 56 ft. in diameter, provided with cone bottoms, decanters and overflow launders. When the charge is settled and decanted down to about 50 per cent. moisture, it is transferred with cyanide solution to the Pachuca tanks. These tanks are of standard size, 15 ft. in diameter and 45 ft. deep, and hold between 80 and 100 tons of slime (dry weight), depending upon dilution. This agitator, requiring air representing in volume and pressure an expenditure of about 3 h.p., is considered, by reason of its simplicity and low operating and maintenance cost, to possess advantages over the various mechanical types, in spite of its great height. Agitation is continued from 6 to 8 hours, and the pulp is then transferred to a large storage reservoir, whence it is delivered to the Butters filter plant, as required.

Two modifications of this procedure will be adopted in the next plant to be erected by the Rand Mines, Ltd. The old system of intermittent slime settlement will be replaced by continuous settlement in Dorr thickeners. In trials conducted with this device it was found impossible to reduce the slime to the same low moisture as the intermittent system, without a much larger capacity than is allowed in American mills, where this device is chiefly applied to the much more simple settlement of slimed mill pulp containing a considerable quantity of fine sand. To compete with intermittent slime settlement on the Rand, a Dorr thickener 40 ft. in diameter cannot handle more than 150 tons of slime per day; but even so, in view of the labor and power consumption involved in handling intermittently settled charges, and the high capital cost of slime settlers, the continuous system would appear to possess distinct advantages.

The continuous agitation of slime is made possible by the system just described; and is particularly well adapted to the newer plants where the height of the Brown agitators can be utilized for the required gravity flow into the Butters stock tank. This system of allowing pulp to flow slowly through a series of agitators was first applied in Mexico; its first application on the Rand was at the East Rand Proprietary about two years ago. It seems likely that all plants to be erected in the future will adopt continuous slime settlement and agitation, followed by vacuum filtration.

Precipitation.

The use of filiform zinc for precipitating gold was introduced on the Rand by MacArthur in 1890. At first no difficulty was experienced in the deposition of gold from the stronger cyanide solutions required for sand treatment; but when it was found possible to recover gold from slime with much weaker solutions, precipitation on zinc became more difficult. It was at this time that the Siemens-Halske electrolytic process, which was more effective than zinc in dealing with these weak solutions, threatened to replace the older method; but owing to serious defects in operation, already touched upon, it was finally abandoned in favor of the zinc method, which had been rendered much more efficient by the immersion of the shavings in a solution of acetate of lead, preparatory to filling the extractor boxes. With this exception, precipitation practice on the Rand does not differ materially from that in other mining districts where filiform zinc is used.

The zinc shavings are cut in the usual manner to a thickness of about 1/500 in. and 1 cu. ft. of such filaments loosely packed, per ton of solution per 24 hours, is the average allowance for capacity of extractor boxes. These boxes, usually built of steel, are from 4 to 6 ft. wide, and of corresponding depth, with 6 to 10 compartments. The existing system of gold precipitation, though highly efficient on the dilute solutions used on the Rand, admittedly possesses many awkward features which have for years stimulated investigation with a view to devising a more compact, positive and less wasteful substitute. Its weak points are: (1) the great area required for plant; (2) the labor required in dressing and cleaning up extractor boxes; (3) the uncertainty of cleanup, owing to the variable distribution of gold not immediately recoverable; (4) the impossibility of recovering at once all gold deposited within a given period; (5) the enormous loss of zinc in the destructive process of recovering its gold content.

The Merrill zinc-dust method, as perfected in America, offered certain distinct advantages over the older process. It is neater and more exact in operation, requires less labor, and possesses the very attractive feature of yielding a complete cleanup of all the gold deposited. After practical trials this process was introduced at three Rand mines; the Brakpan, New Modderfontein, and Modderfontein B.

The consumption of zinc in the Merrill presses is approximately 1-10 lb. less per ton milled than in extractor boxes. The cost at Johnnesburg of cut shavings is 4.2d. per lb., of zinc dust 3.93d. per lb., so that as regards zinc consumption the presses have the advantage. But this is offset by the cost of additional cyanide required to strengthen the slime solutions sufficiently for good zinc-dust precipitation, which was found to be, at New Modderfontein, 1d. per ton milled.

The general opinion in regard to zinc dust, after three years' experience with the process, is that in effecting economies in zinc consumption and labor, and in affording a complete cleanup of gold, it has fulfilled the claims made for it. On the other hand, it requires more vigilance and care in manipulation than the zinc-shaving method, is liable to erratic fluctuations in efficiency without assignable cause, and requires the use of stronger solutions than are actually needed for dissolving purposes.

One cannot escape the conclusion that zinc in any form is far from being the ideal precipitant for gold. In 1913, about 9,000,000 lb. of zinc were consumed by the mines of the Rand. When we consider that the greater part of this irrecoverable loss is due to the destructive method employed in separating the gold from the zinc after deposition, it is evident that the existing system is an extremely wasteful one. For this reason, the subject of gold deposition presents one of the most profitable fields for investigation in the whole realm of metallurgy, and I venture to predict that in this stage in the reduction of gold ores, the most important advances in the future will be made.

THE BELGIAN RELIEF FUND

To tell, even in part, the story of the work in Canada for the relief of the suffering Belgians, is to unfold a record of a series of surprises which is sometimes almost staggering. When, early in September, it was decided to open the fund, and an Executive Committee was formed, it was realized by those having the direction of the campaign that appeal was being made at a time when trade depression was more or less general and when the demands of the Patriotic Fund, the Red Cross Society and other worthy organizations were not only insistent, but immediate. It was hoped, however, that it might be possible to send a shipload of goods from Canada and perhaps even two to the starving people of a brave nation.

Four ships have already been dispatched, and as this is written, arrangements are being completed for the sending of a fifth. A few days ago, Mr. Hector Prud'homme, the honorary treasurer of the Belgian Relief Fund of Canada, was able to announce that the total donations in money and in kind had reached the magnificent total of $1,750,000. What this means can best be judged by referring to another statement recently issued by the International Committee in London, which is handling the work of distribution for several countries. This showed that Canada had given more generously for the cause than any other country in the world, with the one exception, the United States. England, of course, has done splendid work through individuals by providing homes for thousands of the refugees, but in actual cash and other gifts placed at the disposal of the committee, England, Scotland, Wales and Ireland combined, have not been more generous than the Dominion.

There can be only one explanation of a manifestation as satisfactory as it is surprising. The imagination of the citizenship of Canada had been quickened by the story of the bravery and self-sacrifice shown by the Belgians in the early days of the war. Admiration for the army of heroes who held in check the German invader, melted into sympathy for those who, having refused to barter honor for happiness, found themselves homeless and starving in a devastated country in consequence. "Oh!" wrote the mother of twelve children, who sent a parcel to the Montreal headquarters, with a note attached, "if only I could make you understand, you who will receive this, how the hearts of Canadian mothers bleed for you. We think of you, of your homes destroyed, crops ruined, sons slain, and daughters worse than slain, and we pray for you daily. We look upon our own happy children growing up in a land of liberty and of happiness, and we weep for you. I am not rich. The coin I enclose with this letter (a twenty-five cent piece) is small, but my desire to help is big. Will you write to me, that I may pray for you by name?"

This spirit of direct and personal interest in the sufferers has been shown in a dozen different ways; children have emptied their toy banks, women have

sent rings of quaint setting which were plainly heirlooms, school teachers in country districts have banded together to send sums which must undoubtedly have entailed sacrifice, factory workers have given their time and labor, rich and poor have vied with one another in endeavor to express their desire to aid the stricken country in which war is still being waged.

When the collection of goods was begun, a couple of large rooms in the Beardmore building, in which Mr. Prud'homme had his office, were secured for storage and packing purposes. Within three days the inadequacy of these rooms was made manifest. Immediately a whole building was offered rent free, then another, and still others, so that at the present no less than five warehouses are being used by the executive committee in Montreal alone. When the flood of gifts had only just begun to set in, the writer paid a visit to the two rooms at the headquarters. The collection, even at that time was varied almost to the point of the ludicrous, but the impulse to give anything and everything invested the most amazing donations with a dignity which forbade laughter.

But the end is not yet. On November 12th, last, the International Committee in London, having received reports from several special commissioners who had been sent to Belgium to make report on actual conditions at that time, issued a statement announcing that $4,000,000 a month would be required for at least eight or nine months to feed the population. Canada, having done much, must do more and fortunately, she is doing more every day.

The action of the railways in declining longer to carry shipments free of freight charges makes it advisable that money be given wherever possible, so that purchases may be made near seaboard, but the following gifts in kind are especially acceptable at this time: Wheat, flour, canned goods, condensed milk, bacon, blankets, clothing and warm underwear. Whenever possible, would-be donors are advised to communicate through the nearest branch committee or the nearest Belgian Consul, but contributions will be accepted and acknowledged promptly by

HECTOR PRUD'HOMME,
Honorary Treasurer.
Belgian Relief Fund,
59 St. Peter Street,
Montreal, P.Q.

EXPLORATIONS IN YUKON.

Extensive coal and mineral areas in the southwestern corner of the Yukon Territories have been mapped out during the season's operations conducted by Dr. D. D. Cairnes of the Dominion Geological Survey branch of the department of mines.

Dr. Cairnes has been in charge of some important survey work during the past few years. In 1911 and 1912 he delimited the international boundary; last year he explored the White River country and this year he has been devoting his activities to a reconnaisance survey of the Lake Kluane and Lake Aishihiki countries and the territories around the headwaters of the Donjek and White Rivers, including the Nisling district.

The principal geological features have been noted with a view of further investigation work later. While until his report has been presented to his department he said that he could not discuss his discoveries specificaly, Dr. Cairnes stated that he had surveyed some important coal deposits in the vicinity of Burwash Creek in the Kluane Lake country and had located several promising placer and copper areas.

MINING IN ALASKA IN 1914

The annual report on the mineral resources of Alaska and production in 1914 is now in preparation under the direction of Alfred H. Brooks, of the United States Geological Survey. Some of the important features of this report relative to mining development during the year are abstracted in the following statement:

Mining began in Alaska in 1880, and since that time the Territory has produced mineral wealth to the value of $268,000,000. Of this $224,300,000 has been in gold, $19,800,000 in copper, $2,251,000 in silver, $370,000 in coal, and the rest in tin, lead, quicksilver, marble, gypsum, petroleum, etc. Copper mining began in Alaska in 1901, and the total production is about 133,000,000 pounds.

It is estimated that the value of the total mineral output of Alaska in 1914 is $19,248,000, compared with $19,416,000 for 1913. The preliminary figures on gold output for 1914 show a value of $15,900,000; in 1913 the value was $15,626.813. Silver to the value of about $191,000 was produced in 1914, compared with $218,988 in 1913. Though the low price of copper since midsummer greatly curtailed the output of that metal, about 20,850,000 lb., valued at about $2,872,000, was produced in 1914, against 21,659,958 lb., valued at $3,357,293, in 1913. The output of the other minerals, including tin, marble, gysum, quicksilver, coal and petroleum, in 1914 had a value of about $285,000, compared with $272,242 for 1913.

Had it not been for the depression in the copper market the value of Alaska's mineral product would have been considerably greater in 1914 than in 1913. The gold mining industry of the territory as a whole was prosperous during the year, as is made directly evident by the figures on output, but a more important item of progress is the extensive dead work accomplished on larger plants that have not yet reached a productive stage. No progress was made in coal mining, there being in 1914 only one small productive mine in the territory, and that in one of the lignite fields. It is expected that the new law, providing for leasing of coal land in Alaska, will lead to the exploitation of the fields containing high grade coal. The tin, gypsum, marble and petroleum mining industries of Alaska had a successful year.

The certainty of railway connection with the Yukon basin has greatly stimulated both prospecting and mining development. There was a noticeable increase in investigation of large mining enterprises in 1914 compared with previous years. This was due solely to the expectation of cheaper transportation.

Gold.

Placer mines.—The data in hand indicate that the value of the placer gold produced in 1914 was about $10,700,000, or practically the same as that of 1913, which was $10,680,000. The distribution of this output is, however, not the same in the two years. Some increases in the output of the Ruby, Seward Peninsula, Iditarod and Hot Springs districts were made, but, on the other hand, there was a marked decline in the placer gold output from Fairbanks and lesser decreases in some of the smaller camps. The abundant rainfall which occurred in most of the Yukon and Seward Peninsula camps during the mining season of 1914 greatly favored placer operations.

The Chisana district is the only new placer camp developed in 1914. Promising discoveries are reported in the Healy River region of the middle Tanana, and also

a find of placer gold in the upper Tolovana basin, between Fairbanks and Rampart.

About 44 gold dredges were operated in Alaska for the whole or part of the open season of 1914. Preliminary estimates indicate that these dredges produced gold worth between $2,050,000 and $2,300,000. In 1913, 39 dredges were operated in Alaska with an output valued at $2,200,000. The decreased output per dredge in 1914 is accounted for by the facts that in 1913 several of the dredges were working in very rich ground, and that several of the new machines were not completed in time to operate for more than a brief period in 1914. A further handicap to the dredges this year was the fact that the dredging season at Nome opened later than usual. In addition to the 44 dredges operated there were about half a dozen under construction.

Lode mines.—About 26 gold lode mines were operated in Alaska in 1914 and produced gold to the value of about $5,100,000. In 1913, 30 lode mines produced $4,814,813 worth of gold. The decrease in the number of mines is due to the fact that several which were operated in the Fairbanks district in 1913 were idle in 1914. Juneau is and will continue to be by far the most important Alaska lode camp. Important progress was made during the year in the Willow Creek district. The Port Wells district was added to the gold lode producers.

Copper.

The developments made up to midsummer gave promise that 1914 would be the most profitable year in the history of Alaska copper mining. The financial stringency and collapse of the copper market that followed the breaking out of the European war, not only closed down some of the producing mines, but also put a stop to some very important developments. Up to about the first of August seven copper mines were in operation, but at the close of the year only three were still working. Had it not been for the war at least nine copper mines would have been ready to ship ore before the end of the year. Probably the most important events of the year to the copper industry of Alaska were the reopening of the Mamie mine, in the Ketchikan district; the installation of a shipping plant and the opening of the Midas mine, near Valdez; and the completion of aerial trams at the Jumbo and Mother Lode mines, in the Chitina district.

Tin.

The total production of Alaskan tin mines since the industry started in 1902 is about 550 tons of metallic tin, valued at $432,000. In 1914 one dredge was operated on the Buck Creek placer tin deposits throughout the open season. Two others were operated for a part of the season on Anikovik river, working on deposits carrying both gold and tin. Operations were also continued and some tin was produced at the Lost River lode tin mine. All these localities are in Seward Peninsula. Tin was also produced from several deep placer mines in the Hot Springs district, operated chiefly for the recovery of gold. It is estimated that nearly 50 tons of stream tin was recovered from these placers in 1914. This output could be considerably increased, for only a few of the miners make a systematic attempt to recover the tin.

Southeastern Alaska.

Treadwell mines.—The four mines of the Treadwell group, in the Juneau district, were operated throughout the year on the same scale as before. In the Ready Bullion and Seven Hundred Foot mines of this group ore is being developed on the 2,200 ft. level.

The Alaska Juneau is the only other mine in southeastern Alaska which has reached a productive stage. At this property 50 stamps of the first unit were completed in the spring, and work on the installation of the rest of the 600 stamp mill was continued. The main adit tunnel and raise at this mine were completed in 1913, and the underground work in 1914 was therefore devoted to the opening of stoping ground.

Chisana District.

A large part of the stampeders who went to the Chisana district in 1913-1914 returned without realizing their expectations in the new camp. Nevertheless some rich placer ground has been found in this district, though the total bulk of auriferous gravels so far developed is not large. The total gold output from the district in 1914 had a value of about $250,000. It came chiefly from Bonanza creek, but there was also a considerable output from Little Eldorado and Skookum creeks.

COAL MINING IN CHINA*

By William Barclay Parsons.

China's mineral wealth is both varied and abundant. Coal is found in great quantities generally throughout the country; in fact, there is scarcely one of the eighteen provinces but that contains coal in paying quantities. Through lack of extensive railways and of power-consuming industries, except a few factories at Shanghai and other treaty ports, and on account of the great poverty of the people, consumption of coal per capita in China is very small. Nevertheless, something like 15,000,000 tons is produced annually from the Chinese mines. The coals found include lignite, bituminous and anthracite, with the intermediate grades of semi-bituminous and semi-anthracite.

At present the greatest producing districts are the metropolitan province of Chili, where the Kaiping mines are the largest and best known, and Shansi. The former field produces chiefly bituminous and the latter anthracite. Shantung, Hunan, and the province of a million tons each. In Kiangsi there are located the Ping Hsiang mines, producing an excellent grade of coal, which is coked on the ground and transported now by railway to the Hsiang River, and thence by boat down the Hsiang and Yangtze to be used in China's sole blast furnaces at Hankow. These mines are Chinese owned, but developed by foreign engineers, and are equipped with thoroughly modern and efficient machinery.

The mines worked by natives are very singular. The native attacks a vein at its outcrop and usually, for some unknown reason, at a point where the vein works down the seam. He drives simply a small tunnel not over five ft. high and not over four ft. wide, in order to avoid timbering, and carries this downward until he reaches a point where his native pump can no longer handle the inflow of water. When that point is reached the mine is considered as worked out and is abandoned. A Chinese coal mining district, therefore, presents a view on a larger scale somewhat like the mouths of the burrow pits of the western prairie dog, with a multitude of small waste piles dotting the hillsides. From this initial drift there are no side galleries and no rooms. On the floor of the drift are laid two longitudinal timbers, like rails. The coal is loaded into wicker baskets and then hauled up the drift on the rails by manual power. In the Hunan native mines inspected by the writer the only lighting system was that of joss sticks of punk, giving of course, nothing but a very faint glow.

*Extracts from an article published in the Journal of the Franklin Institute, April, 1915.

A great deal of Chinese coal is coking coal. Some of the anthracite is sufficiently hard and firm to stand the burden of a blast furnace, though nearly all is much softer than its American namesake, similarity existing in chemical composition. A great part of the bituminous coal, however, carries a large percentage of ash, and very much of it is in structure so friable as to produce but a small portion of lump. When the coal deposits can be worked on a large scale and generally throughout the country, it will be found undoubtedly advantageous to crush most of the coal, wash it, and then either convert it into coke or to compress it into briquettes. The principle of briquetting has already been adopted by the natives, who take the coal dust, mix it with clay, and sell the clay balls in the Chinese cities for local consumption. By washing the coal from the Ping Hsiang mines, from which is made the coke for Hankow iron works, the ash content is reduced from as high as 28 per cent. to 8 per cent., and the sulphur from 0.65 per cent. to 0.1 per cent.

There has never been any approach to a complete scientific study of either coal or other mineral resources of China. About forty years ago von Richthofen made the first attempt to describe Chinese mineral wealth, and his publications, meagre as a first survey in such a huge country must necessarily be, are still referred to authoritatively. The Carnegie Institution of Washington sent, in 1903, a staff consisting of Messrs. Willis, Blackwelder, and Sargent, who explored a portion of the country. Other writers have also taken it up in part. Until the country has been thoroughly and systematically studied, it is impossible to say how great is China's wealth in coal. Enough, however, has been shown to indicate that China probably possesses at least as much coal as does the United States.

Of other minerals China has her share. Iron ore, and of good grade, is found generally throughout the country, but in large quantities only in a few localities. Owing to the fact that up to date there has been but one blast furnace in existence, although others are under construction, the iron ore deposits have been developed on a large scale only at Tayeh, near Hankow, in proximity to the furnace. This ore shows, on analysis, metallic iron ranging from 60 per cent. to 62 per cent., with phosphorus and sulphur as low as 0.05 per cent. Copper is found generally throughout the western part of the country. Tin is found and worked to a considerable extent. Petroleum is found in the northern and western part of the country, and an arrangement has been recently entered into between the Standard Oil Company and the government for its development on a commercial basis. Lead, zinc, and antimony also occur; in fact, of the last metal the world's largest single producer is China. Gold and silver are also found, but up to date only in comparatively small quantities.

The control of the mining deposits in China has been placed in charge of the Minister of Industry and Commerce, and a set of rules has been drawn up regulating the opening and working of mines, but, unfortunately, these rules are hedged in with so many Chinese restrictions that they do not attract capital on a large scale. It is instructive as showing the Chinese view of foreign participation, and also amusing, to read the opening paragraph of the mining regulations, to the effect: "The industrial enterprises of China are still in their infancy, and the inclination of the people to launch into industrial enterprises has not yet been developed; therefore, it is inevitable that foreign capital should be introduced, but as the nation has been so weak, it is feared that many interests and privileges will be lost. Consequently, in the question of development by foreign means there should be restrictions. Should there be foreign shares, they should not exceed forty per cent. of the total amount of the capital."

Although the regulations appear to be fair, in a detailed examination by one with a knowledge of Chinese methods there will appear all sorts of opportunities for vexations and delays.

BOOK REVIEW.

THE MINING MANUAL AND MINING YEAR BOOK,

1915—By Walter R. Skinner, London 1915—Price, in England, 15s. elsewhere 17s.—For sale by book department, Canadian Mining Journal.

This is the twenty-ninth annual issue of Skinner's well known manual.

The work covers every section of the Mining Market, and many mines whose shares are not dealt with on the London Stock Exchange are included. In a world-wide industry like that of mining there are continual changes in progress, and consequently to embody every new phase, unwearied labor and much time are absolutely necessary. Neither has been spared to maintain the reputation of the Mining Manual and Mining Year Book, which, for completeness and accuracy, has stood unrivalled from its very inception. Every individual notice has been carefully revised and officially verified wherever possible. In previous volumes the work has been divided into sections, but with the present volume all companies are arranged alphabetically. This innovation has been decided upon owing to many of the companies widening their scope of operations and transferring their interests from one mining field or market to another. This has been a notable feature in recent years in connection with many finance companies whose interests have become so divided that although their title suggests a certain field of operations their list of holdings proves otherwise. At the same time the Index has not been abandoned, since it is thought that—especially to those not very familiar with Stock Exchange momenclature —it will be found helpful for cross-references. Thus "Chartered" will be found in the Index with a cross-reference to British South Africa Company and "Gold Fields" with a cross reference to Consolidated Gold Fields of South Africa. The object of the Mining Manual and Mining Year Book has always been to keep in touch with a company from its birth until its demise, and to carry out this policy, but at the same time avoid the work becoming too unwieldy, a new feature has been introduced, viz., a Supplementary Index. This Index, which immediately follows the Index proper, contains the names of those companies which have ceased to be of public interest or are in too dormant a state to justify their inclusion in the body of the work. By turning to the volume set opposite their names full particulars can be ascertained. Thus while particulars are supplied in the volume itself of 2,420 companies, the supplementary Index with its references to earlier volumes covers no less than 2580 additional companies.

A CHANT OF HATE AGAINST ENGLAND

By Ernst Lissauer in "Jugend".
(Rendered into English verse by Barbara Henderson.)

French and Russian, they matter not,
A blow for a blow and a shot for a shot;
We love them not, we hate them not.
We hold the Weichsel and Vosges-gate,
We have but one and only hate,
We love as one, we hate as one,
We have one foe and one alone.

He is known to you all, he is known to you all,
He crouches behind the dark gray flood,
Full of envy, of rage, of craft, of gall,
Cut off by waves that are thicker than blood.
Come let us stand at the Judgment place,
An oath to swear to, face to face,
An oath of bronze no wind can shake,
An oath for our sons and their sons to take.
Come, hear the word, repeat the word,
Throughout the Fatherland make it heard.
We will never forego our hate,
We have all but a single hate,
We love as one, we hate as one,
We have one foe and one alone—
ENGLAND!

In the Captain's Mess, in the banquet-hall,
Sat feasting the officers, one and all,
Like a sabre-blow, like the swing of a sail,
One seized his glass held high to hail;
Sharp-snapped like the stroke of a rudder's play,
Spoke three words only: "To the Day!"

Whose glass this fate?
They had all but a single hate.
Who was thus known?
They had one foe and one alone—
ENGLAND!

Take you the folk of the Earth in pay,
With bars of gold your ramparts lay,
Bedeck the ocean with bow on bow,
Ye reckon well, but not well enough now.
French and Russian they matter not,
A blow for a blow, a shot for a shot,
We fight the battle with bronze and steel,
And the time that is coming Peace will seal.
You will we hate with a lasting hate,
We will never forego our hate,
Hate by water and hate by land,
Hate of the head and hate of the hand,
Hate of the hammer and hate of the crown,
Hate of seventy millions, choking down.
We love as one, we hate as one,
We have one foe and one alone—
ENGLAND!

—New York Times.

A REPLY.

(In reply to the above, and on the day of its publication, the Times received the following from Beatrice M. Barry:)

French and Russian, they matter not,
For England only your wrath is hot;
But little Belgium is so small
You never mentioned her at all—
Or did her graveyards, yawning deep,
Whisper that silence was discreet?
For Belgium is waste! Ay, Belgium is waste!
She welters in the blood of her sons,
And the ruins that fill the little place
Speak of the vengeance of the Huns.
"Come, let us stand at the Judgment place,"
German and Belgian, face to face,
What can you say? What can you do?
What will history say of you?
For even the Hun can only say
That little Belgium lay in his way.
Is there no reckoning you must pay?
What of the Justice of that "Day?"
Belgium one voice—Belgium one cry
Shrieking her wrongs, inflicted by
GERMANY!

In her ruined homesteads, her trampled fields,
You have taken your toll, you have set your seal;
Her women are homeless, her men are dead,
Her children pitifully cry for bread;
Perchance they will drink with you—"To the Day!"
Let each man construe it as he may.
What shall it be?
They, too, have but one enemy;
Whose work is this?
Belgium has but one word to hiss—
GERMANY!

Take you the pick of the fighting men
Trained in all warlike arts, and then
Make of them all a human wedge
To break and shatter your sacred pledge;
You may fling your treaty lightly by,
But that "scrap of paper" will never die!
It will go down to posterity,
It will survive in eternity,
Truly you hate with a lasting hate;
Think you you will escape that hate?
"Hate by water and hate by land;
Hate of the head and hate of the hand."
Black and bitter and bad as sin,
Take you care lest it hem you in,
Lest the hate you boast of be yours alone,
And curses, like chickens, find roost at home
IN GERMANY!

POTASH FROM FELDSPAR.

Owners of feldspar properties in the neighborhood of Kingston are experimenting in the extraction of potash from feldspar. Potassium is one of the commonest elements in rocks; but the difficulty of extracting it is very great. A large proportion of the potash used in America has been imported from Germany, where more easily treated potassium salts are found. The advance in price since Germany's exports were cut off is stimulating research here, and it is hoped that an economic process will be found so that the enormous feldspar deposits of Canada can be used for the production of potash, for which there is a great demand, especially for use as a fertilizer.

PORCUPINE VIPOND MINES, LIMITED, ANNUAL REPORT.

In the report of Porcupine Vipond Mines, Ltd., for the period May 1, 1914, to Dec. 31, 1914, Mr. C. H. Poirier, manager, says: Construction of a syanide addition of 120 tons daily capacity was started on May 10, 1914, and carried on through the summer. The plant, which is of the continuous counter-current decantation type, was put in operation on September 1st, 1914, and has been run continuously since that time.

The total cost of the addition was $24,617. This included the stripping of the old building and the removal and replacement of various parts of the crushing section to fit into the changed flow sheet.

While the cyanide plant was being erected the mine was unwatered, and underground work was started on August 1st.

Development.

During the period the following development was carried out:

	Drifts.	Crosscuts.	Raises.
100 ft. level ...	215.8	27.5	186.4
200 ft. level ...	133.5	26.4	....
300 ft. level	23.8	28.8	....

Production.

Tons treated, 9.559 tons.

Gold bullion produced, 3,217.95 fine oz. ..	$66.514.58
Silver bullion produced, 413.84 fine oz.	200.57
Precipitate on hand Dec. 31st	3,758.77
Refinery slag on hand Dec. 31st	2,304.00
Solutions..............................	1,186.00
	$73.963.92
Tailing loss	8,309.25
Total value of ore treated	82,273.17
Average value per ton	8.60+
Loss per ton	.86+
Extraction............................	90%

The tonnage treated was drawn from the following sources:

Stopes..............................	6,633 tons
Development..........................	988 tons
Dump.................................	1,938 tons
Total................................	9,559 tons

Costs.

Costs for the four months during which the mill was in operation are as follows:

	Total.	Per Ton Milled.
Mining...............	$19,415.55	$2.03
Milling...............	15,187.62	1.59
Refining and marketing	1,353.27	.14
Development..........	10,188.95	1.06
General— Supervision, Surface Insurance, Taxes Organization head office	15,513.56	1.62
		$6.44

* In the above are included all costs for ore broken and not milled, no deferred charges are carried for development. Mill absorption and loss due to starting new plant are written off, and extraordinary expense incident to unwatering and reopening mine and starting operations after a long shut-down are included.

There has been a constant improvement in conditions underground on the property. The continuation of the main ore shoots has been proven to the lower levels and lateral development shows a very satisfactory extension of payable ore along the strike of the Davidson vein.

Adjustments in the mill have resulted in an increased saving, and costs have decreased in every department. *

In view of the short time during which the mill was in operation during the year 1914, the following figures covering the period from Jan. 1st, 1915, to March 31st, 1915, are given for comparison:

For Period Jan. 1st to March 31st, 1915:

Tons milled, 6,898; bullion produced, $74,558.42; recovered per ton, $10.81; total costs per ton, $5.71; profit per ton, $5.10.

The estimated ore reserves on March 1st amounted to 40,900 tons of developed ore of a gross value of $355,055.00 and 7,400 tons of broken ore in stopes valued at $73,355.00, a total of 48,300 tons of a gross value of $428,410.

Balance Sheet Porcupine Vipond Mines, as at December 31st, 1914.

Assets.

Mine and Plant—		
Accounts receivable	112.01	
Mine.....................		$872,831.56
Plant as at April 28, 1914...	$77,547.35	
Additions to plant	33,848.95	
	111,396.30	
Deduct—		
Depreciation of 5%	3,877.37	107,518.93
		980,350.49
Bullion assets—		
Bullion in transit	$12,067.32	
Precipitates and slag	4,176.77	
Mill solution	1,186.00	
		17,430.09
Current assets—		
Cash.....................	$645.92	
Materials and supplies on hand	11,844.61	
Unexpired Insurance	1,987.74	
		14,581.28
Accounts in adjustment		3,365.36
Treasury stock reserved for contracts ..		16,125.30
Deficit Account—		
Net loss transferred from exhibit "D"		3,437.98
		$1,035,290.50

Liabilities.

Capital stock—		
Authorized.............	$1,500,000.00	
Deduct Treasury stock ..	600,000.00	
		$900,000.00
Bonded indebtedness—		
Bonds of the Ward Porcupine Mines Co., Ltd, assumed, due June 14, 1915..............		65,400.00
Current liabilities—		
Accounts payable	45,390.50	
Notes payable	24,500.00	
		69,890.50
		$1,035,290.50

Profit and Loss Account.

For the three months ended March 31, 1915

Gross proceeds from ore treated		$74,558.42
Deduct—		
Mining costs	19,384.50	
Milling costs	11,192.77	
General expense	8,792.88	
Depreciation	4,031.96	
		43,402.11
		$31,156.31
Deduct—		
Refining and marketing expense		1,207.77
Operating profits		29,948.54
Deduct—		
Administration expenses	844.77	
Interest charges	1,723.44	
Organization expenses	775.00	
		3,343.21
Net profits transferred to Exhibit "A"		$26,605.33

Porcupine Vipond Mines, Ltd., Annual Report, 1914.

The report of President H. H. Ward is in part as follows. Inasmuch as the period up to December 31, 1914, was devoted to building the cyanide addition to the plant, unwatering and reopening of the mine, resumption of development operation, and continuance of the same during a period of five months, overhauling of the plant, which had been idle for 18 months, adjustment of added plant after putting it in operation, that part of the report covering this particular period cannot give a clear idea of present conditions. In addition to the extraordinary costs made necessary by the operations mentioned above, a considerable amount of deferred charges was carried over into this period. However, inasmuch as the fiscal year of the company begins the first of the calendar year, a separate financial report is made for the period ended December 31, 1914, and the balance as shown on that statement will be carried on to the next annual financial report.

The reports covering the period from January 1, 1915, indicate the result of operations for this period as shown by the reduction in outstanding indebtedness, increased balances of cash and bullion on hand, increased ore reserves and increased daily mill capacity. In order to accomplish this increased mill capacity is was necessary, in addition to making original adjustments, to install new classification system and make other changes, which necessitated shutting down the mill for a period of 13½ days. The results for the three months' period should, therefore, be measured as for 76½ days, and not for the full period.

Although one or two additional changes of comparatively small cost are in contemplation, the purposes of these changes being to bring the present capacity of certain units up to full capacity of the plant as a whole, the mill may now be considered as complete so far as present plans and present ore reserves warrant; and as it stands, and with the few changes proposed, will be capable under normal conditions of treating 100 to 120 tons per day.

On account of the unusually small precipitation in Northern Ontario during the past winter there has been a shortage of water power throughout the camp during the month of March. This, however, has not interfered with mill operations, but it has curtailed development work to some extent. It is gratifying to know, however, that even during this period of reduced available power, ore development has more than kept pace with the tonnage treated, and it is anticipated that the plant will be running full capacity both above and below ground within two weeks. (Full power made available April 15th).

Owing to the fact that a large part of ore during 1914 was taken from the dump, which had never been entirely cleaned up, and therefore, contained a large percentage of ore from the original development, the mill heads were low during this period. The character of ore now being developed justifies the expectation that in the immediate future head values will more closely approximate recent figures than those of 1914. As will be seen from reports, the heads during the four months of 1914 ran $8.60 per ton as against $11.50 for the period from January 1, 1915, to March 31, 1915. Not only the condition of the mill, but the character of the dump ore under treatment account for an extraction of 90 per cent. during the 1914 period as against the present extraction of 95 per cent.

It is felt that the conditions as to the organization and administration of the property are now in a satisfactory condition. Although the financial plan which had been arranged when the company was organized was not carried to completion, individual shareholders will not suffer thereby. On account of the necessary abandonment of the plan upwards of 150,000 shares of stock which would otherwise have been issued are held in the treasury. The company was obliged to borrow in order to secure funds to complete the plant and meet current expenses, and the indebtedness thus created, together with the bond issue, must be entirely looked out for out of earnings instead of partly out of stock subscriptions as was the original plan.

It is recommended that bondholders be invited to extend for one year the terms of their bonds, subject to an agreement with the company, to continue interest payments at the present rate of 7 per cent. per annum; the bonds to be subject to call of the company within the one year period, on 30 days' notice, and a payment of a bonus of 1 per cent.

John Bryden.

The late Mr. John Bryden, who died at his home at Esquimalt, near Victoria, B.C., on Saturday, March 27, was one of the pioneers in building up the important coal mining industry of Vancouver island. He was born in Ayrshire, Scotland, on December 4, 1831, so was in his eighty-fourth year. In the autumn of 1862, he left Scotland for Vancouver island, going by way of the Isthmus of Panama and San Francisco and thence to Esquimalt. Late in that year, or early in 1863, he settled at Nanaimo, where he was joint manager with Mr. Mark Bate for the Vancouver Coal Mining and Land Co., which in 1861 had purchased from the Hudson's Bay Co. the coal mines it had been working there since 1852. In 1873 he was joined by Mr. E. G. Prior (now Colonel Prior, of Victoria), who as mining engineer and surveyor under him engaged in the work of developing the mines. Some years later, about 1880, Mr. Bryden became manager of the Wellington collieries for Mr. Robert Dunsmuir, one of whose daughters he had married in 1867. Later he represented Nanaimo district in the Legislative Assembly of British Columbia, and as the years passed he was actively identified with various industrial enterprises on Vancouver island and elsewhere in the province. He was chairman of a Commission ap-

pointed about twelve years ago, following a disastrous explosion at Coal Creek, Crow's Nest Pass, to report on matters connected with coal mining in the province, and the Coal Mines Regulation Act, afterward passed, was based largely on the findings and report of that Commission. Colonel Prior, in closing a striking tribute of appreciation of his late friend, published in the daily press, said: "There are, I am sure, hundreds who think like myself that here was a man who, by his blameless life and splendid example of how a man should live, has left the world better than when he came into it."

PERSONAL AND GENERAL

Mr. W. H. Aldridge has been in Northern Mexico on mining business.

Mr. Barclay Bonthrone, of Vancouver, B.C., recently made a trip to the mining country around Hazelton, in Omineca division of British Columbia.

Mr. D. D. Cairnes, of Ottawa, has gone to Yukon Territory to do field work for the Geological Survey of Canada during the ensuing season in the neighborhood of Stewart river.

Mr. Henry Clark, of Victoria B. C., representative of Head, Wrightson & Co. England, manufacturers of mining machinery, after having spent two months in New South Wales, Australia, will visit New Zealand before returning to British Columbia.

Mr. J. C. Dufresne, who before joining the Water Branch of the Provincial Government service in British Columbia was for several years engaged in connection with the mining and smelting industry of that province, has volunteered for active service in the European war.

Mr. E. E. Guille, formerly one of the lessees of the Granite-Poorman gold mines near Nelson, B. C., has been reported as seriously wounded in France, to which country he went with the first Canadian contingent.

Mr. A. H. Gracey is continuing the development of the Venus gold mine on Morning mountain, near Nelson, B. C., and will operate the neighboring Athabasca stamp-mill in treating Venus ore.

Mr. J. Cleveland Haas, of Spokane, Washington, has been examining mining property in Ainsworth camp, on the west side of Kootenay lake, B. C., for Spokane owners.

Mr. Frederic Keffer, who with Mr. Henry Johns recently opened a mining engineers' office in Spokane, is convalescent after several weeks' serious illness. Both gentlemen filled responsible offices on the staff in British Columbia of the B. C. Copper Co. and only a few months ago retired from the company's service to commence a consulting and mine-managing business on their own account.

Mr. Frank E. Lathe, for some months associated with the metallurgical instruction department of Toronto University, has returned to the laboratory of the Granby Consolidated Co. at its big copper smeltery at Grand Forks, B. C.

Mr. Douglas Lay, for some time acting manager for the Le Roi No. 2, Ltd., at Rossland, B. C., during the absence in England of Mr. Ernest Levy with his family took passage from New York City to England the first week in May. The steamship "New York," in which he sailed, was reported as having been torpedoed shortly after the Lusitania was lost, but later advices told of her safe arrival at Liverpool.

Mr. F. Charles Merry, formerly superintendent for the Ferguson Mines Ltd., with mines in the Lardeau district of British Columbia, and who left that province for Utah a few weeks ago, was in New York City last month.

Mr. N. J. Ogilvie, of Ottawa, is again engaged in the Northwest in connection with the completion of the work of delimiting the International boundary line between Canada and Alaska.

Mr. T. A. Rickard, of San Francisco, editor of Mining and Scientific Press, has lately been in Nevada.

Mr. Frank A. Ross, of Spokane, Washington, formerly general manager for the Marcus Daly estate of the Nickel Plate group of gold mines and 40-stamp mill in Camp Hedley, Similkameen, B. C., last month read before the Spokane Mining Men's club a paper on the subject of "Speculation in Mining Stocks." The paper aroused much interest and it has since been given publicity over a wide area.

Mr. G. Stilwell, of near Silverton, Slocan lake, British Columbia, is among a large number of Kootenay district recent volunteers for war service at the front. He had been for many years in charge of development work on the Hewitt and Lorna Doone mines, situated about five miles from Silverton, and which are now shipping ore to a concentrating mill on Four-mile creek, mines and mill being operated by the Silverton Mines, Ltd.

Mr. Frederic R. Weeks, after having been for some time engaged in directing exploration and prospecting of a large group of mineral claims on Copper mountain, Similkameen, B. C., for the British Columbia Copper Co. and associated organizations, has zeen examining, with Mr. C. Minot Weld also of New York City, the mining properties of the Granby Consolidated Co. for New York bankers who have since underwritten $2,000,000 of the Granby Co.'s 6 per cent. bonds to facilitate the financing of its extensive copper mining and smelting enterprises in British Columbia and elsewhere.

Mr. Scott Turner, manager of the Arctic Coal Co. Spitzbergen, was among the passengers rescued from the Lusitania.

Capt. John Donnelly, president of the Donnelly Wrecking Co. Kingston, has been elected vice-chairman of the Board of Governors of the School of Mining, Kingston. Capt. Donnelly is a graduate of the School of Mining and an esteemed member and ex-councillor of the Canadian Mining Institute.

The Cobalt branch of the Canadian Mining Institute visited Porcupine mines last week. Dr. F. D. Adams and H. Mortimer-Lamb of Montreal and Col. A. M. Hay, J. B. Tyrrell and R. E. Hore of Toronto accompanied the party.

Three mining engineers, Julius Madero, Raoul Madero and Albert E. Blair, graduates of the Michigan College of Mines, who have taken a prominent part in affairs in Mexico during the past few years have recently been heard from. Mr. Blair is now in charge of business interests of Francisco Madero Sr. with headquarters at San Pedro. Mr. J. Madero is superintendent of cotton plantations. Mr. Raoul Madero is now governor of the state of Nuevo Leon, with headquarters at Monterey.

Mr. H. M. Hotchkin and Mr. R. E. Margenau are at Haileybury.

Mr. H. R. Lyman has returned to Cobalt from Florida.

Mr. H. D. McCaskey succeeds Mr. Parker in charge of the Division of Mineral Resources, U. S. Geological Survey.

Mr. John O'Sullivan, F.C.S., who died at Vancouver, British Columbia, last month, was one of the best known assayers on the western coast of Canada, where he had an extensive connection and enjoyed the confidence of

all with whom he came into contact. After his father and family had removed from the southwest of Ireland to Swansea, Wales, the son was taken into Vivian's laboratory, where he had the advantage of being under Dr. Suchsland, chief assayer. He diligently improved his opportunities there until, in 1897, Dr. Suchsland was instrumental in securing for him an appointment in Vancouver. Ere long Mr. O'Sullivan opened an assay office for practice of his profession on his own account, and during the comparatively long period that has since elapsed he built up a connection and established business relations over a large area of country in the Pacific North-West. In private life, too, he was held in very high esteem, having a wide circle of friends who greatly deplore his death.

HEINZE ESTATE MUST PAY TAXES.

The Supreme Court of Canada has dismissed the appeal of the Heinze estate against the Province of British Columbia in the matter of the taxation of lands in that province. In 1895 the British Columbia Smelting and Refining Co. was organized with F. Augustus Heinze as president and H. C. Bellinger as general superintendent. By this time the Le Roi, Centre Star, and War Eagle mines had been established as ore-producers, so Mr. Heinze, who was at the head of a smelting works in Butte, Montana, turned his attention to the new mining camp, which had been shipping gold-copper ore to the Colorada smelting works, Butte. After much negotiation, he made a contract with the management of the Le Roi mine for 37,500 tons of ore on the dump, which he would pay for after the shipment and sampling of each lot, deducting $11 a ton for freight and treatment charges; also for a second similar quantity on which the charges should be at the lowest rates obtainable in the open market. With that quantity of ore contracted for, a land grant secured from the Provincial Government, and a bonus promised of $1 per ton smelted from the Dominion Government, the smelting company was organized, the smeltery at Trail built and equipped, a narrow-gauge railway constructed from the reduction works twelve miles to the mines, and in February, 1896, the first furnace was blown in, followed by four others later in that year. In 1896 Mr. Heinze obtained a charter for the construction of the Columbia and Western railway from Trail along the Columbia river about 30 miles and thence westward into the Boundary district, where large bodies of copper ore—those since developed by the Granby, British Columbia Copper, Dominion Copper, and other companies—were known to occur. As a bonus or subsidy for the construction of this railway, the British Columbia Government made a grant of approximately 600,000 acres of land situated in Kootenay and Boundary districts. After construction of the railway had been commenced, Heinze, in 1893 sold his smelting works and railway interests to the Canadian Pacific Railway Co., except that he retained an undivided one-half interest in the railway-subsidy lands. Under the terms of the Railways Aid Act, by effluxion of time the lands eventually became taxable; meanwhile the C. P. R. Co. had sold to the British Columbia Government all its interest in the lands. Prior to this the C. P. R. Co. had unsuccessfully brought suit against Heinze in the courts to compel him to choose his half of the lands. None of the lands having been registered in Heinze's name, all became the property of the Crown, subject of course to Heinze's half-interest. The situation having thus become complicated by the reversion to the Crown, the position being that the government could not tax the lands because they were registered as Crown Lands, an act was passed, in 1913, by the Provincial Legislature giving power to tax and sell all such lands, and thereafter the government proceeded to assess Heinze's interest in the Columbia and Western railway lands. In July, 1914 a judge of a court of rivision was appointed to hear Heinze's appeal against such tax assessment, and judgment was in due course given in favor of the Crown. Then Heinze appealed to the Court of Appeals, Victoria, B. C., and having failed in that court the Heinze estate, Heinze having meanwhile died, carried the matter to the Supreme Court of Canada, which, on May 4 dismissed the appeal, which means that the estate will now have to pay a comparatively large sum as taxes on the lands so long held free from taxation.

INTERNATIONAL NICKEL.

The belief is held in some quarters that the current three months' period will set a record for any three months in the history of the International Nickel Co. The company's fiscal year began April 1 with a record demand for nickel and prices for copper that had not been attained in many months. The use of nickel steel in the construction of automobile engines and nickel in the manufacture of cartridges has brought about an increase in the consumption of the metal, due to the heavy demand for both of these commodities.

The recent declaration of a 5 per cent. quarterly dividend from the earnings of the fiscal year ended March 31 is an indication that business in the last quarter of the fiscal year was exceptionally good as the dividend is the largest quarterly disbursement which the company has made since it was incorporated in 1902.

Last year the company had a large amount of nickel on hand which it held in anticipation of the present higher prices.

An official of the company recently said that business is "extremely good" and in view of the fact that the present war has precipitated an abnormal demand for nickel, the company's earnings are reflecting this increase in business. Another factor favorable to the company is the high price of copper, of which metal the company produces a large amount. In the fiscal year ended March 31, 1914, the company produced approximately 18,000,000 pounds of copper and were it not for the lower level of copper prices the company would have set a new record year for earnings.

The following table gives the record of earnings which shows 1913 to have been the best previous year. Interests closely allied with the company, however, freely express the belief that the forthcoming report, for the year ended March 31, 1915, will set a new record while the current year gives every indication of even greater earnings. Results in past years follow:

Year	Total Income $	Net Income $	%	Year's Surplus $
1914	6,566,786	6,128,974	11.1	454,759
1913	6,929,106	6,386,799	*11.7	994,501
1912........	5,088,965	4,866,412	26.3	902,798
1911........	5,256,938	5,028,874	27.9	2,432,074
1910........	3,348,681	3,144,734	17.2	1,044,805

*Common stock increased from $11,582,626 to $38,031,500.—Wall St. Journal.

SPECIAL CORRESPONDENCE

COBALT, SOUTH LORRAIN AND GOWGANDA

The pumping out of Cobalt Lake is proceeding with much rapidity. All the south end of the lake opposite the McKinley Darragh and Nipissing plants is dewatered. At the other end it is falling almost a foot a day and there is no reason to doubt that all the water will be out in a month. Before the first rock cut lowered the lake six ft. last fall it was estimated that 300 million gallons of water was contained in the lake. The pumps have each a capacity of 3,500 gallons a minute; but no necessity has been found to run them at full capacity.

The burning of the Chambers Ferland shaft house near the O'Brien line suspended operations for only a few days. It is up this shaft that all the ore that is now going to the Northern Customs concentrator was hoisted, no ore coming from the new shaft yet and the other old shaft near the La Rose line being closed down. The fire originated in the ore house which has not been used for some time and may have come from a short circuit or a dropped cigarette, but probably the former. The shaft house, ore house, and blacksmith's shop were all burned and it will entail a loss of about $7,000, $4,000 of which is covered by insurance.

Savage—The vein found on the Savage property of the McKinley Darragh Savage group while only eighty ft. long on the 195 ft. level and apexing at the 140 ft. is yet so rich that it is yielding a very considerable amount of ore. For 80 ft. on the 195 level it will run four to five ins. wide of ore that averages 6,000 oz. to the ton. This has enabled the Savage to maintain a production of 40,000 to 50,000 oz. a month, mill ore and high grade together. The McKinley Darragh mill is running three days a week on Savage ore and already 50,000 tons of ore has come over the aerial tramway from the Savage to the mill. Of this part has been mine ore and part dump. All this winter the mill has been running on mine ore; but dump ore is now being conveyed across again and it is estimated that there are yet on the dumps between 6,000 and 10,000 tons.

Temiskaming—Development at the Temiskaming mine continues to yield good results. Development on the 400 ft. level on the Temiskaming side shows ten to eleven in. of most wonderful ore and it is reported that a new vein has been cut near the Gans line.

Nipissing—The hydraulic plant of the Nipissing has commenced to strip the overburden off the Peterson lake area of which 95 acres were cleared last year. There is about two month's more work to do. The stripping costs just short of $500 an acre.

The Princess mine has been leased to Mr. Sidney Smith of Haileybury on a royalty basis. For the present only one drill is working on the 55 ft. level, but more will be set to work later. The mine has been pumped out to the 132 ft. level.

The Miller Lake O'Brien mine at Gowganda is again at work at full capacity. During the spring the water was so low in Gowganda Lake that the power plant was unable to supply sufficient power to keep the mine running at capacity and the wood has been cut for such a long distance back that it was felt that it was more economical to run with reduced force than to incur the heavy expense of much further cutting.

Homestake—Work has been started on the Homestake claims on Wigwam Lake. Camps were built some time ago and now a small force of men have been put on to sink shafts and develop some very promising silver surface veins. Mr. Geo Rogers, who was in charge of the Mann mine for several years, is in charge of operations.

The Temiskaming and Hudson Bay mining company has determined to resume work at the No. 2 camp, adjoining the strip of ground once held by the Little Nipissing company south of the McKinley Darragh mine. Two shafts have already been sunk and connected. From the 350 ft. level a diamond drill was operated which showed that there was a depth of 320 ft. of conglomerate and a conglomerate area twice as large as that at the No. 1 workings. So far no ore has been found here. The management state their intention of thoroughly prospecting this ground and will devote a year to doing it.

Nipissing—In April the Nipissing mining company mined ore of an estimated value of $170,577 and shipped bullion from Nipissing and customs ore of an estimated value of $380,921. The high grade mill treated 132 tons and shipped 756,568 ozs. The low grade mill treated 5,206 tons. The production was distributed as follows: high grade mill, $96,358, low grade mill $74,219.

The White Reserve mine at Maple Mountain is again being worked. The Toronto syndicate operating it has sent in supplies for a small gang of men. Drills will be at work almost at once. All supplies have to be taken up the Montreal river from Latchford by water.

PORCUPINE, KIRKLAND LAKE AND SWASTIKA

The Lucky Cross mine at Swastika is to be worked once more. A syndicate has taken an option on the property and it is understood that $40,000 is at once available for its development. While the mine was being worked several levels were opened up exposing some orebodies which appeared to be very promising A small mill was also built and a few gold bars produced; but the extraction was very low. It will require several thousand dollars to put the mill into condition to make efficient treatment possible.

The Huronia mine in Gauthier township is now being sampled in behalf of Messers L. H. and N. A. Timmins. Mr. Pare, the first manager of the Hollinger mine is in charge. It is understood that if the property is taken up the first payment will be made in June.

Dome Lake—After being closed down for a week only, the Dome Lake mining company has resumed work with a reduced staff. Only one shaft is being run at the mine since enough ore can be broken then to keep the mill running at capacity. In a statement made on behalf of the management by Mr. George Taylor, the president, it is stated that eleven bars of bullion worth $4,255 have been produced and shipped to date and 123,700 lbs. of concentrates were also shipped.

Imperial—Mr. H. L. Taylor, president of the Porcupine Imperial has bought a three drill compressor and will take it in over the road to the property at once. He has been working for some time by steam, but since he has now drifted 300 ft. on the 100 ft level it is now getting difficult to operate without air.

Dome—The annual report of the Dome will show that there has been a heavy reduction in costs in every department. Last year's annual report showed total costs at $4.19, this year they have been reduced to $2.96 which includes 70 cents per ton charged for development. The grade is now running $4 a ton. When a bigger proportion of the ore is hoisted from the 400 and 500 ft. levels it will run a little better than that while the costs will certainly be reduced to $2.50. The mill costs have been cut from $1.44 a ton to less than a dollar a ton. On the charge of transportation and crushing costs have been cut by 50 per cent. The mill is now treating 850 tons every 24 hours and it will gradually be increased to a thousand tons.

There is no immediate prospect of an extension of the mill although part of the new issue of stock is designed to finance the addition when the mine is ready for it. The mill is working very satisfactorily and making an extraction of 95 per cent.

Alexo Nickel—In the east drift at the Alexo nickel mine developments latterly have been very encouraging. The drift is now 237 ft. long and there is now in the face 12 ft. of ore of a good grade of nickel.

In the west drift also encouraging results are being obtained in the winze sunk below the level. During April bad roads from the mine caused suspension of shipments for a fortnight; but they were resumed on May 5. In April 664 tons was shipped in 18 cars.

Vipond—The diamond drill working at the 200 and 300 ft. level of the Vipond mine has been pulled up after three holes had been drilled in order to test the formation and to discover the trend of the veins being worked. A raise has now been put through from the 300 to the 200 ft. level.

Success.—There is every probability that the Success mine will be worked again. Though no actual options have been closed several offers have been made to the Clark estate. The Success has been closed down for several years. Its four claims adjoin the east claim of the Vipond.

Hollinger—At the present time in order to suit the emergencies of the case seventy stamps are dropping on Hollinger ore and 30 on Acme. The forty additional stamps were originally all intended for the Acme; but the Hollinger mine is now being developed so rapidly that the ore being broken is far larger than the mill can treat and it was deemed wiser to lend ten stamps temporarily to the bigger mine.

Tough-Oakes—A very satisfactory extraction is being made at the Tough-Oakes mill and several substantial shipments of gold have been made from it.

In the mine the drift on the 300 ft. level to the west is in very good ore. It has been pushed 300 ft. from the shaft and the face is in remarkable ore.

Goodfish—The ore in the shaft being put down by Mr. Frank Loring on the Gibson claims at Goodfish Lake is two and a half ft. wide at the bottom and assays very well indeed. The shaft is now down 60 ft. Goodfish Lake is about a mile from the Tough-Oakes mine.

BRITISH COLUMBIA

First Aid at Coal Mines.—Following the holding of classes of instruction in "First Aid to the Injured" in coal mining districts in the province, there have been recent examinations by surgeon-examiners acting under the auspices of the British Columbia Council of the St. John Ambulance Association. Those familiar with the procedure provided for in the general regulations of that association know that those who pass the first examination in First Aid are entitled to the certificate of the association, which is evidence of the competency of the person to whom it is granted to render first aid to sick or injured along lines laid down in the authorized text book of the association. The next step is to obtain a voucher, by, a year later, passing a second examination in "First Aid"; then follows a third examination, also at an interval of twelve months, success in which entitles to the medallion of the association, and thereafter, also at yearly intervals, further examinations may be taken for the label, which is a small clasp to be worn with the medallion. Recently 60 men qualified for one or other of these distinctions. At Michel, Crowsnest district, 23 passed, as follows: For certificate 13, voucher 6, medallion 1, and label 3. At Merritt, Nicola valley, 17 passed, as follows: For certificate, 10, voucher 4, medallion 2, and label 1. At Ladysmith, Vancouver island, 20 passed, as follows: For certificate 15, voucher 3, and medallion 2. While it is by no means a new development to have men qualify themselves to render first aid in cases of emergency in the districts above-mentioned, nor in other mining districts in British Columbia, the addition of more to the list of those already qualified is at all times pleasing, the more so since it means the probable lessening of suffering and, in some instances, possible saving from death, where sudden illness, accident or other emergency shall require prompt action until skilled medical or surgical services shall be available.

Increase in ore receipts.—The figures showing the quantity of ore received at the Consolidated Mining and Smelting Co.'s smeltery at Trail, West Kootenay, during seventeen weeks ended April 29 of the current year are satisfactory, since they indicate a substantial increase when compared with the receipts for the corresponding period of 1914, which was before war conditions had arisen to seriously disturb the markets for metals and otherwise interfere with the ordinary progress of mining and smelting operations. The respective totals were 141,293 tons to the end of April of this year, and 111,424 tons for the corresponding period of last year. The increase was, consequently, between 26 and 27 per cent. It should be pointed out, however, that there is not yet room for unmixed satisfaction, since the increase was not general; for instance, Ainsworth, Slocan, and Nelson divisions of West Kootenay, respectively, made a much smaller output of silver-lead ore, while there was also a decrease in, or rather an entire suspension of, shipment of copper ore from mines in Nelson division. The reduction in output of lead-bearing ores from the three divisions mentioned was offset to a considerable extent by a substantial increase in the quantity received from the Sullivan Group mine in East Kootenay. The larger increases were: From Rossland mines 37,694 tons, East Kootenay mines 7,343 tons and State of Washington mines 3,960 tons. The chief decreases were: From Nelson mines 7,801 tons, Slocan mines, 5,715 tons and Ainsworth mines 5,057 tons. As the largest producer of last year in Slocan division—the Standard silver-lead mine—is about to resume production, as are, also, several other mines in Slocan and Ainsworth divisions, it is unlikely that there will be so large a decrease in output of silver-lead ore from those divisions during the ensuing similar period of four months.

The Granby Consolidated Co. having got back to normal rate of production, with all eight of the blast furnaces in operation at its smeltery at Grand Forks, the mining situation is improved to that extent in

Phoenix camp. Published figures give the monthly totals of ore shipped from the company's mines at Phoenix to its smeltery at Grand Forks as follows: For January 42,211 tons, February 63,091 tons, March 69,948 tons, April 85,382 tons; total for four months 260,632 tons. The Jewel gold mine, in Greenwood division, is the only other present regular producer in the district, but its output is small in comparison with that of the Granby mines; still, since it gives regular employment at mine and stamp mill to about 30 men, its operations are a welcome addition to the industrial life of the Boundary. Occasional carload shipments of high grade ore are made from small properties around Greenwood, beside which prospecting is active in Franklin camp and neighboring parts of the country up the north fork of Kettle river, above Grand Forks.

Coast District.

New copper mine.—Another mine has been added to the list of copper producers in the Coast district of British Columbia, namely, the Rocher Deboule mine, which recently made its first bulk shipment, consisting of about 450 tons of ore, consigned to the Granby Consolidated Co's smelting works at Anyox, Observatory inlet. This property is described at some length by Mr. John D. Galloway, assistant mineralogist, in Bulletin No. 4, Omineca Mining Division, issued a few weeks ago by the Provincial Department of Mines. It is situated in Juniper basin at the head of Juniper Creek, and is situated ten miles from Skeena Crossing, a flag station on the Grand Trunk Pacific railway ten miles westerly from New Hazelton. The property comprises six mineral claims on Rocher Deboule mountain; it is owned by the Rocher Deboule Mining Co. There are three main veins, in granodiorite; the highest vein contains copper-iron minerals, the middle and lowest veins galena and zinc. In August, 1913, the mine was leased to the Montana Continental Development Co., a Butte, Montana, organization. Under the terms of the lease, this company agreed to equip the mine with machinery, construct the aerial and surface tramways requisite for the transportation of ore to the railway, and develop the top vein by a crosscut adit, in return for the right to extract as much ore as possible during a two years' tenure of lease. The lessee company put in on Juniper creek, about five miles above Skeena Crossing, a small hydro-electric power plant and constructed a transmission line thence to the mine; installed a 6-drill Canadian Rand compressor; drove a crosscut adit about 500 ft. to the vein; constructed a surface tramway to the upper terminal of the aerial tramway near the summit of a ridge overlooking Skeena river, and built the aerial tramway, in two sections, nearly four miles down to orebins on a spur from the railway at Carnaby; erected mine buildings, and put in a portable sawmill driven by a 20-h. p. electric motor. The main vein is described as varying from 2 to 12 ft. in width and including a fairly regular shoot of from 1 to 4 ft. of ore, samples of which taken by Mr. Galloway ranged up to 1.20 oz. gold and 1.80 oz silver to the ton and from 9 to 13.3 per cent. copper.

Other properties on Rocher Deboule mountain being worked are the Red Rose, which has ore ready for shipment, and the Great Ohio group.

Silver-lead near Hazelton.—Several silver-lead properties in the neighborhood of Hazelton are preparing to ship ore. The Silver Standard group, on Glen mountain, four miles east of Old Hazelton, last year shipped to Trail 736 tons of ore that contained approximately 200 oz. of gold, 122,000 oz. of silver, and 282,000 lb. of lead. Production was discontinued when the metal markets were disorganized by the outbreak of war in Europe, but now that the ore can be disposed of it is intended to resume shipping to the smeltery. The American Boy is on Nine-mile mountain, eight miles from New Hazelton. Last year 48 tons of ore was sent to Trail to determine value in bulk. There occurs on the group of eight mineral claims a series of parallel veins on four of which development work has been done. Mr. Galloway states that the American Boy, like the Silver Standard, has a considerable quantity of ore that could be handled at a profit if concentrated before shipment. Freight and treatment charges were last season about $23 a ton, exclusive of the cost of hauling down the hill to the railway at New Hazelton, so that under the conditions only high-grade ore could be shipped at a profit. Average assay returns from ore on the main dump from the shaft on No. 3 vein show a value of more than $20 a ton, but of course, such ore may not at present be shipped crude; it should, however, be possible to effect a simple water-concentration that would result in a product running from $150 to $200 a ton, Another prospective shipper is the Silver Cup group of four claims, also situated on Nine-mile mountain, under lease to George and Roy Clothier who last season opened a body of good ore and have already commenced this season's work. Several veins have been found; half a dozen drifts have been run on the main vein at different elevations. A test shipment of 23 tons of selected ore contained about 140 oz. of silver to the ton. A sampling of 10 tons of this ore before shipment showed it to also contain lead 46.1 and zinc 12.4 per cent. There are as well in the country tributary to Hazelton other camps in which development of mineral claims has been undertaken, information concerning which is included in Bulletin No. 4, above-mentioned, which is obtainable gratis on application to the Department of ines, Victoria.

DOME MINES CO.

Pres. De Lamar said at the annual meeting of Dome Mines Co., Ltd. at Toronto: "We have been waiting to get the present mill to full capacity and to its full efficiency as to saving of values. For the last six months this has averaged between 20,000 and 23,000 tons per month, with a saving of 90 per cent. to 91 per cent. of values. Our general manager says that in May he will be able to mill 25,000 tons; next month he hopes to get up to 27,000 tons, and in 30 days thereafter to get up to full capacity, between 28,000 and 30,000 tons per month. He is saving 94 per cent. of values.

"As it was intention of directors to establish a dividend basis which we could continue to maintain, it was necessary to know what the mill would turn out. In 60 to 90 days from now we should be able to prove it, and then establish dividends. We are still working with a baby mill; and this mill has paid for present mining, milling and housing equipment, as the company had no working capital.

"The plan is to double the capacity of this mill within the same mill building, without loss of time, and with this completed and the mine well developed we shall be able to build a mill of much larger capacity, depending entirely on tonnage developed with the money now being contributed for new stock.

"We have an ore body of great length and width and fair values, and the old rule still holds good in mining —that when you cannot pay dividends from quality, you may from quantity, if the ore holds out, and my 40 years of mining experience tell me it will hold out for very many years."

MARKETS

STOCK QUOTATIONS.*

(Courtesy of J. P. Bickell & Company, Standard Bank Bldg., Toronto, Ontario.)

May 22, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	35.12½	35.37½
British Copper	.62½	.87½
Braden Copper	7.00	7.25
California Oil	281.00	283.00
Chino Copper	43.50	44.00
Giroux Copper	.50	1.50
Goldfield Cons	1.43½	1.50
Green Can	28.00	30.00
Granby	80.00	81.00
Inspiration Copper	29.00	29.25
International Nickel	132.00	136.00
Miami Copper	23.75	24.50
Nevada Copper	14.50	14.75
Ohio Oil	135.00	137.00
Ray Cons. Copper	23.00	23.25
Standard Oil of N. Y.	184.00	186.00
Standard Oil of N. J.	393.00	396.00
Standard Oil (old)	1300.00	....
Standard Oil (subs.)	900.00	....
Tonopah Mining	6.87½	7.12½
Tonopah Belmont	4.37½	4.62½
Tonopah Merger	.36	.40
Yukon Gold	41.50	41.62½

Porcupine Stocks.

	Bid.	Ask.
Apex	.03¾	.03⅞
Dome Extension	.08½	.09
Dome Lake	.14	.14½
Dome Mines	14.00	14.30
Foley O'Brien	.25	.34
Hollinger	25.00	27.00
Jupiter	.10¼	.11
McIntyre	.42½	.43
Moneta	.05	.05½
Pearl Lake	.01	.01½
Porcupine Gold	.00⅝	.00⅞
Porcupine Imperial	.06¾	.07
Porcupine Crown	.83	.84
Preston East Dome	.02½	.03
Rea	....	.11
West Dome	.00¾	.04

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02⅝	.02¾
Beaver	.34	.35
Buffalo	.60	.90
Chambers Ferland	.17	.19
Coniagas	4.85	5.00
Crown Reserve	.78	.80
Foster	.03½	.04
Gifford	.02	.03
Gold Reef	.03½	.05
Gould	.00⅛	....
Great Northern	.02¾	.03
Hargraves	.01	.01½
Hudson Bay	20.00	21.50
Kerr Lake	4.75	5.00
La Rose	.56	.58
McKinley	.26	.29
Nipissing	5.70	5.85
Peterson Lake	.24½	.25½
Right of Way	.04½	.04¾
Rochester	....	.03⅝
Teck Hughes	.04¾	.05
Temiskaming	.35½	.35¾
Trethewey	.14¼	.19
Wettlaufer	.44¾	.05
Seneca Superior	1.20	1.25
Homestake	....	.21
York Ontario	....	.08¼

SILVER PRICES.

May—	New York cents.	London. pence.
8	50	23 9/16
10	50⅛	23⅝
11	50⅛	23⅝
12	50⅛	23⅝
13	50	23⅝
14	50	23⅝
15	50	23 11/16
17	50	23⅝
18	49⅞	23 9/16
19	49¾	23½
20	49¾	23 9/16
21	49¾	23 9/16
22	49¾	23 9/16
24	49¾	Holiday
25	49⅞	23⅝

TORONTO MARKETS.

May 26—(Quotations from Canada Metal Co., Toronto)—

Spelter, 22 cents per lb.
Lead, 5½ cents per lb.
Tin, 45 cents per lb.
Antimony, 40 cents per lb.
Copper, casting, 21 cents per lb.
Electrolytic, 21 cents per lb.
Ingot brass, yellow 13c.; red, 15 cents per lb.

May 26—(Quotations from Elias Rogers Co., Toronto)—

Coal, anthracite, $7.50 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

May 25—Connellsville coke (f.o.b. ovens)—

Furnace coke, prompt, $1.50 to $1.55 per ton.
Foundry coke, prompt, $2.00 to $2.40 per ton.

May 25—Tin, straits, 38.00 cents.

Copper, Prime Lake, 18.50 to 18.75 cents.
Electrolytic Copper, 18.37½ to 18.62½ cents.
Copper wire, base, 20.00 cents.
Lead, 4.30 cents.
Spelter, 18.75 to 19.25 cents.
Sheet zinc (f.o.b. smelter), 19.50 cents.
Aluminum, 25.00 to 26.00 cents.
Nickel, 45.00 to 48.00 cents.
Platinum, soft, $40.00 per ounce.
Platinum, hard, 10 per cent., $42.00 per ounce.
Bismuth, $2.75 to $3.00 per pound.
Quicksilver, $74.00 per 75-lb. flask.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN—New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1913.

NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.

ONTARIO
Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.

YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.
Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N. S.

QUEBEC
Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.
Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA
Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography.
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.

YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BUYERS AND SELLERS OF METALS

The Canadian Miner's Buying Directory.

Air Hoists—
Canadian Ingersoll-Rand Co., Ltd.

Amalgamators—
Fraser & Chalmers of Canada, Limited.
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
C. L. Constant Co.

Assayers' and Chemists Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Ball Mills—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Mussens, Ltd.

Beams—Steel—
Dominion Bridge Co.
Mussens, Ltd.

Belt Tighteners and Clamps—
Dodge Mfg. Co., Ltd.

Belting—Leather, Rubber and Cotton—
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

Blasting Batteries and Supplies—
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited

Blowers—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

Boots—
Dodge Mfg. Co., Ltd.

Buckets—
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

Chain Blocks—
Mussens, Ltd.

Chemists
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Mining Exposives—
Curtis & Harvey (Can.), Ltd.
Canadian Explosives, Limited

Coal Mining Machinery—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Collars—
Dodge Mfg. Co., Ltd.

Compressors—Air—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Concentrators and Jigs—
Fraser & Chalmers of Canada, Limited.
James Ore Concentrator Co.
Mussens, Ltd.

Concrete Mixers—
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.

Condensers—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
Peacock Bros.
Northern Canada Supply Co.

Conveyors—Belt—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Converters—
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Mussens, Ltd.

Conveyor—Trough—Belt—
Hendrick Mfg. Co.

Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
M. Beatty & Sons, Ltd.
Boving & Co. of Canada, Ltd.

Cranes—Electric—
Mussens, Ltd.

Cranes—Overhead Traveling—
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Crane Ropes—
Mussens, Ltd.
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Lymans, Ltd.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Fraser & Chalmers of Canada, Limited.
Roessler & Hasslacher.
Thos. & Wm. Smith.
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamonds (for Diamond Drills)—
Abe. Levine.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith and Travers.

Dredging Machinery—
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers of Canada, Limited.

Drills, Air and Hammer—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Mussens, Ltd.

Dump Cars
Sullivan Machinery Co.
Mussens, Ltd.

Drills—Electric—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.

Elevator Cups—
Dodge Mfg. Co., Ltd.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers of Canada, Limited.
Roberts & Schaefer Co.
Boving & Co. of Canada, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Oil—
Peacock Bros.
Boving & Co. of Canada, Ltd.

Engines—Crude Oil—
Boving & Co. of Canada, Ltd.

Engines—Steam—
Fraser & Chalmers of Canada, Limited.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Fans—Ventilating—
Fraser & Chalmers of Canada, Limited.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.

Fixtures—Counter Shaft—
Dodge Mfg. Co., Ltd.

Flights—
Hendrick Mfg. Co.

Floor Stands—
Dodge Mfg. Co., Ltd.

Friction Clutches—
Dodge Mfg. Co., Ltd.

Forges—
Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

Generators—
Northern Electric Co., Ltd.
Peacock Bros.

Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

Heaters—Feed Water—
Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

Hoisting Engines—
Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

Hose—
Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
International Nickel Co.

Motors—
Mussens, Ltd.
Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Nickel—
International Nickel Co.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
C. L. Constant Co.
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

Producer—Gas—
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Pulleys—Iron, Wood Spit, Iron Centre Wood Rim—
Dodge Mfg. Co., Ltd.

Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
Smart-Turner Machine Co.

Quarrying Machinery—
Mussens, Ltd.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Fraser & Chalmers of Canada, Limited

Rolls—Crushing—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

Roofing—
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville

Rope Blocks—
Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

Screens—
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons.

Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Spiral Conveyors—
Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

Stacks—Smoke Stacks—
Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.

Stamp Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Steel Drills—
Sullivan Machinery Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley.
C. L. Berger.

Switchboards—
Northern Electric Co., Ltd.

Take-ups—
Dodge Mfg. Co., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited
Hendrick Mfg. Co.

Tramways—
Mussens, Ltd.
B. Greening Wire Co., Ltd.

Transformers—
Northern Electric Co., Ltd.
Peacock Bros.

Transits—
C. L. Berger & Sons.
Peacock Bros.

Transmission Rope—
Dodge Mfg. Co., Ltd.

Trippers—
Dodge Mfg. Co., Ltd.

Tube Mills—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

Winding Engines—
Mussens, Ltd.
Peacock Bros.
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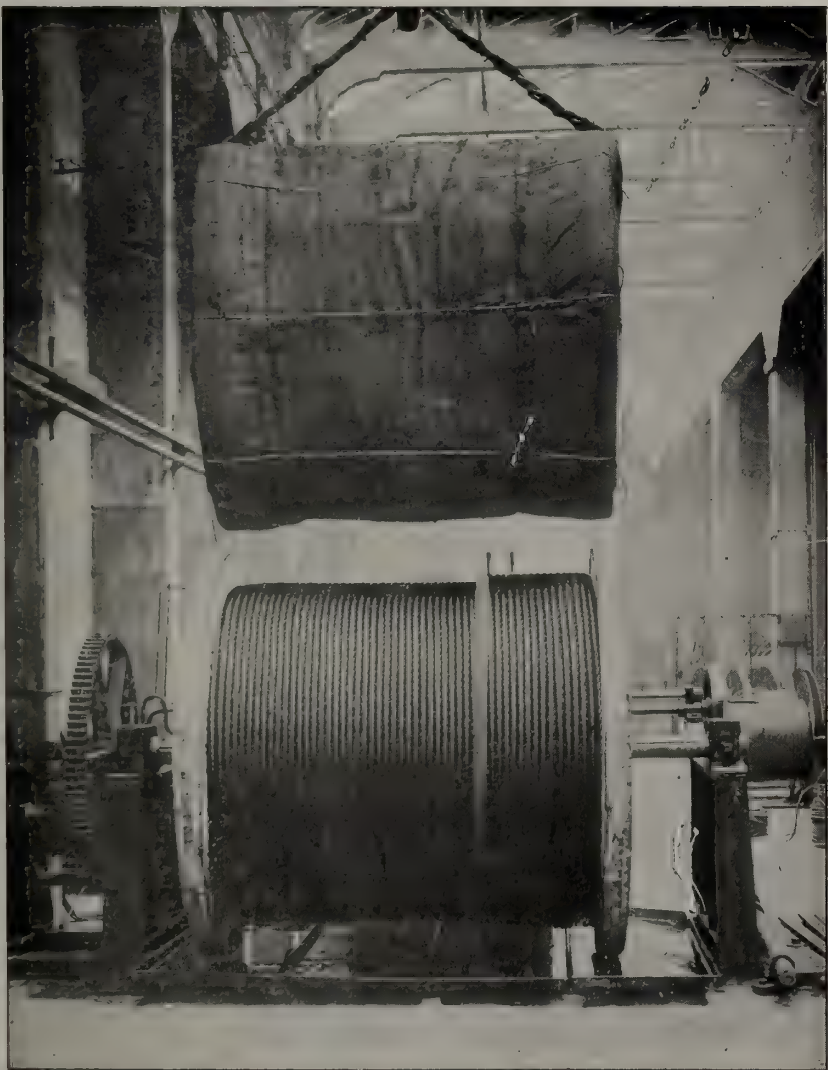

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CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 12

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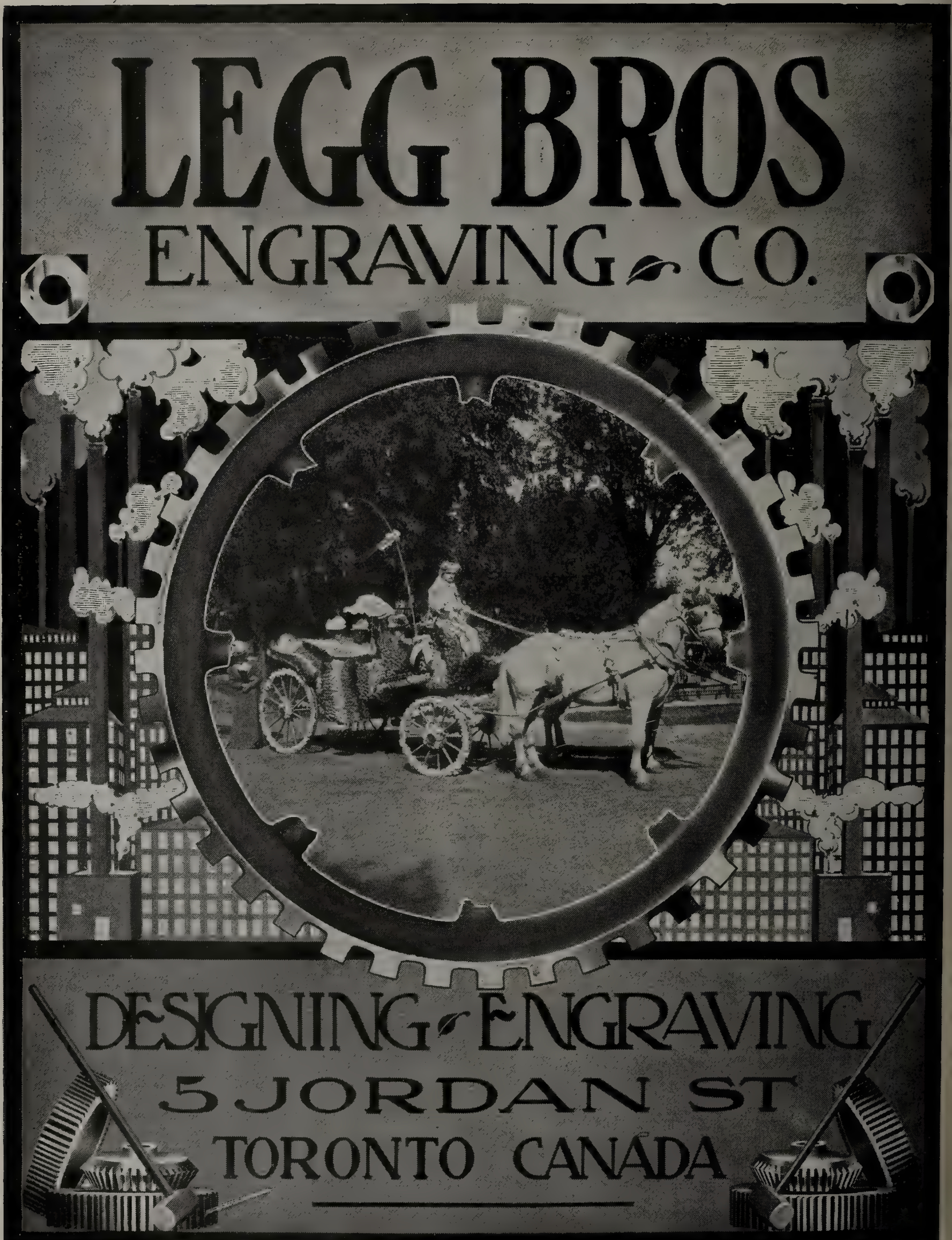

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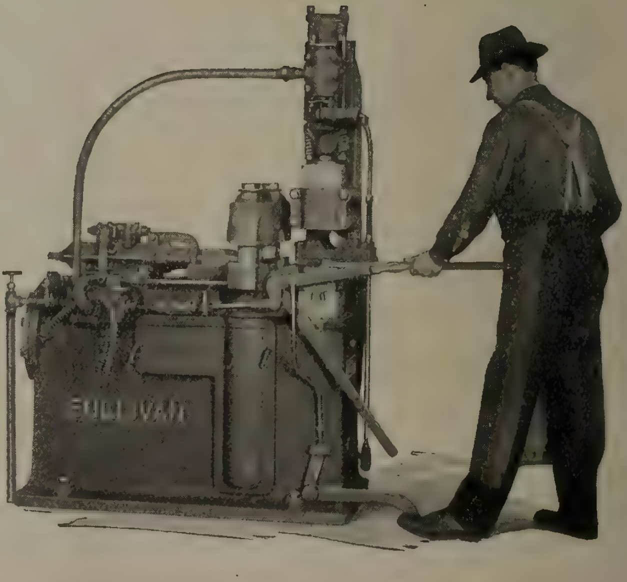

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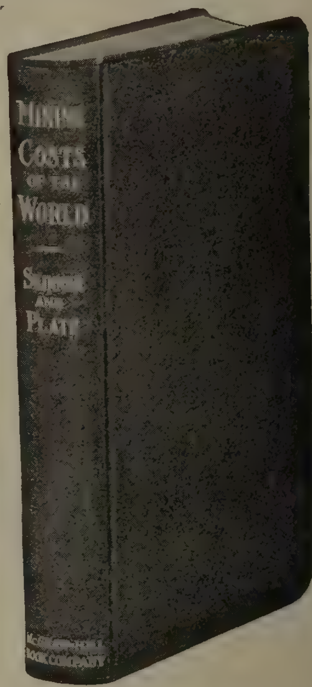

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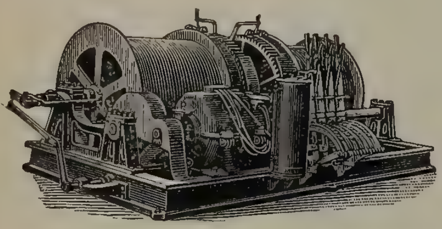

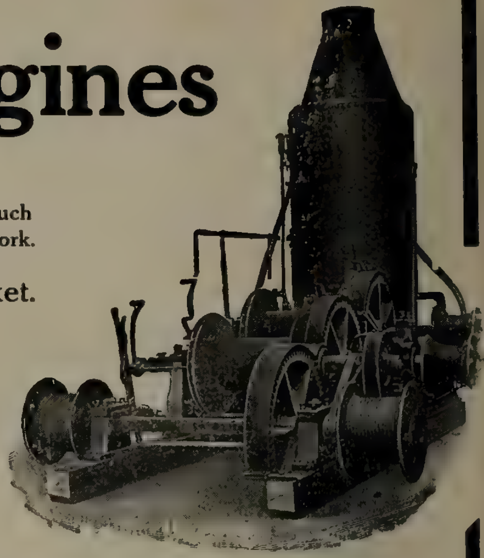

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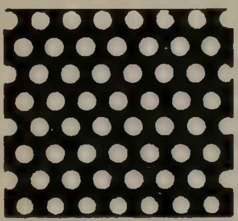

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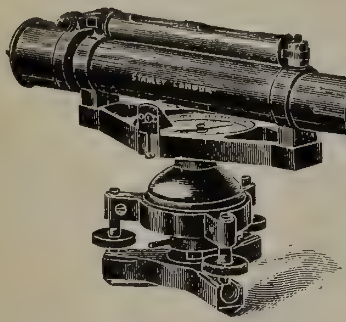

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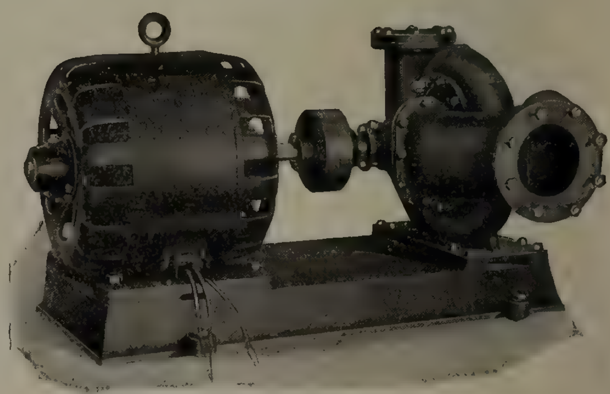

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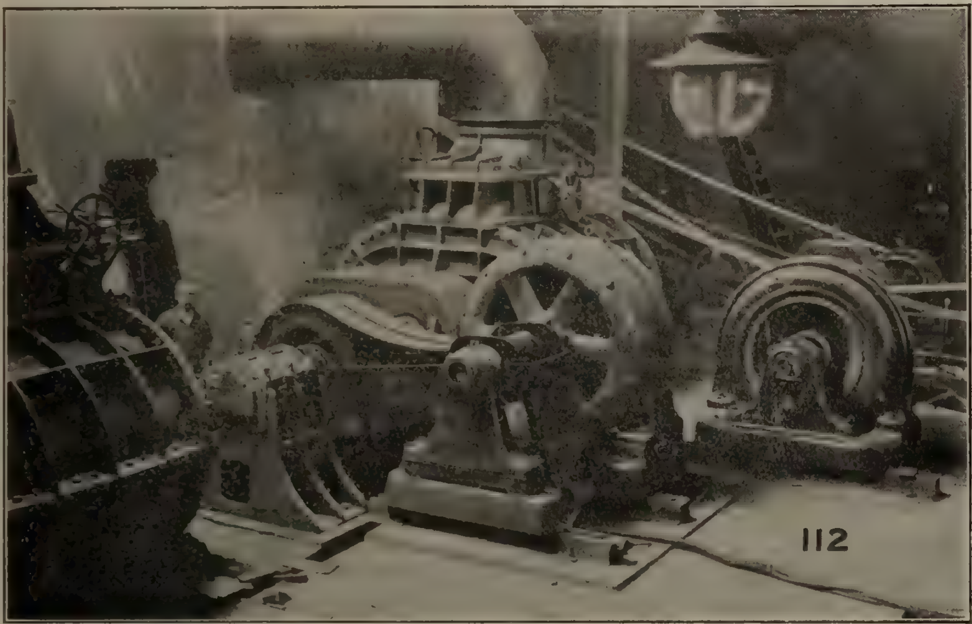

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, June 15, 1915. No. 12

The Canadian Mining Journal

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Editor

REGINALD E. HORE

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CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

ALIEN ENEMIES

According to a press despatch from Fernie, the Coal Creek mines of the Crow's Nest Pass Coal Company ceased operations on June 9, owing to the miners going on strike because the company refused to immediately discharge all German and Austrian employees.

We are not yet aware of all the facts which led up to this action on the part of the miners, and it is possible that the aliens may have made themselves so obnoxious that loyal citizens felt called upon to clear out the undesirables. If, however, the alien enemies were attacked simply because of their nationality, then the striking miners need not look for praise from fair-minded citizens.

Unquestionably the mining camps should be freed from the class of men who are unwilling either to be loyal subjects of the British Empire or to keep their German opinions to themselves. But a man may be a good citizen even though he be not naturalized. There are many decent, industrious men of German nationality in Canada who are a credit to the Dominion and who have earned the right to live and work here during war as during peace.

There are many loyal Canadians out of work in some of the mining camps in which alien enemies are employed. It is, therefore, natural that there should be complaints from certain quarters. Why should the companies employ Germans and Austrians, while others are idle? Why are these subjects of the mad war lords allowed in our midst? Why are they not dismissed by their employers? Why are they not interned? These questions are frequently asked and deserve an answer. That is why we venture to suggest that the alien enemies have rights which should not be lost sight of.

It is evident that some of the alien enemies in the mining camps are thoroughly in sympathy with the German Government. Of these some have been foolish enough to give voice to their joy at the successful accomplishment of criminal acts such as the sinking of the Lusitania. Avowed enemies such as these should be promptly interned.

On the other hand there are many Germans who are either not in sympathy with the German war lords or who take care to conduct themselves in a manner not hostile to the country in which they live. Such men we should not hastily throw out of work, for their labor is useful to the country as well as to themselves. Why should we make public charges of men who would otherwise be productive workers? And even if there were no economic loss, is it fair that these men who are striving to live as becomes decent citizens should be made to suffer because others of the

same nationality have been unwise enough to openly approve of the mad policy of the Kaiser and his brood? The men employed in the mines have won their positions by their work, and so long as their work is satisfactory to their employers and their conduct satisfactory to the public it will be grossly unfair for anyone seeking personal interests to ask that they be refused employment.

In the case of those enemies whose conduct is unseemly, agitation for internment is the proper course. The companies should not be called upon to dismiss such men, however. The cases should be investigated by Government officials and the undesirables should be interned.

COPPER SMELTING IN CANADA

In connection with the manufacture of shells in Canada there is a popular demand that all the materials used be Canadian products entirely. It is stated that steps are being taken to encourage the smelting and refining in this country of all the metals used. It is to be hoped that as a result of such encouragement new industries will be established here.

Some curious misstatements of fact are, however, being made in this connection. One Toronto newspaper reports a member of the shell committee as stating that practically no copper is smelted in Canada. As a matter of fact, a very large amount of copper ore is smelted in Canada. The Granby Company alone in the year ending June 30, 1914, smelted, at Grand Forks and Anyox, B.C., 1,289,000 tons of copper ore. There was produced in Canada in 1914 about 26,276,000 lb. blister copper as well as 12,582,000 lb. copper matte and 92,772,000 lb. nickel-copper matte.

While Canada has in operation several large smelting plants, practically all the smelter products are sent to other countries to be refined. At present we produce and smelt more than enough copper ore for our own use; but are obliged to import the refined products. We exported in 1914 smelter products containing 75,411,623 lb. copper and imported about 28,280,810 lb. crude and manufactured copper and 1,143,039 lb. copper sulphate, besides other copper manufactures.

Copper, electrolytic, was marked up to 20 cents a lb. last week, the highest price since 1907, and lead sold at six cents. The demand for metals must eventually lead to increased interest in the development of mining properties.

At the Dome mill about two-thirds of the gold is recovered by amalgamation and one-third by cyanidation. The recovery by the two processes in the past financial year was respectively \$671,054 and \$384,442. This indicates that the ore milled is very similar in character to that mined in early operations, and that the practice decided upon after careful testing of the ore near surface needs no serious modification.

CALUMET AND HECLA.

Houghton, Mich., May 29.

A splendid testimonial of respect, of confidence and of regard was last evening paid to James MacNaughton, general manager of the Calumet and Hecla Mining Company and associated companies by the employees of those corporations when Mr. McNaughton was presented with an engraved gold watch and printed testimonial bearing the names of the 8,266 employees who contributed towards its purchase.

The presentation was made on behalf of the Calumet and Hecla and subsidiary companies' employees by James Sharpe of the Hecla machine shop. Mr. Sharpe read to Mr. MacNaughton the following letter, expressing the sentiment of the employees:

"The employees of the mines, mills and smelters of which you are general manager, wishing to show you and the general public, the esteem in which they hold their general manager, decided that a letter signed by each and every employee, would be the best testimonial of their feelings.

"We know that it was principally due to your attitude of "no compromise" that the copper country is not afflicted with the presence and under the control of the Western Federation of Miners.

"We know that from years of experience that any one of us having a grievance or thinking he has a grievance can have justice done him by bringing his trouble to your notice.

"We thank you and ask you to convey to the directors of the various companies our thanks for the wage bonus for the eight months prior to May 1, 1915.

"We have each contributed five cents towards the purchase of a token of our esteem, and know you will accept it in the spirit in which it is given, not considering its monetary value, but remembering that it shows the good will of 8,235 employees, each of whom contributed his mite towards its purchase."

Mr. McNaughton voiced his appreciation as follows:

"The greatest satisfaction any employer of labor can have is to know that his employees are happy and prosperous, and anything that he can do that will conduce to those conditions he is in honor bound to do. If I have contributed towards the prosperity and happiness of the employees of these companies I have only done what was my duty. The thanks of the employers are due to the boards of directors of the various companies and to the broad-mindedness and liberality of two men who guided the destiny of the Calumet and Hecla so many years; I refer to Mr. Shaw, Sr., and to Mr. Agassiz. Their spirit of fair-mindedness and fair dealing has been handed down to the present board of directors, who have only done what they would have done if they were still living.

"Loyalty and efficiency go hand in hand. Judging from the efficiency we are getting to-day, and it is the highest in the history of the companies, I know we are getting loyalty.

"I don't know how and can't thank you for this testimonial of your regard and feeling. Coming as it does so soon after a year of turmoil and trouble, your act is a notification to the entire world that the people of the copper country and employees of these companies who know the management of the companies

best do not and never have taken any stock in the lies told during the year. I thank you from the bottom of my heart for this testimonial, but above all for the kindly feeling and good will that prompted this act."

THE CALL OF THE MOTHERLAND

(By Bernard Malcolm Ramsay, in the Financier, London.)

Over the lands and the waters, outsinging the song of the sea,
There comes to the ear of Britain the voice of her children free—
The sons who have wrought and fought for Britain and Liberty.

* * * * * * *

Back in the mists of the ages Britain was born to be blest,
Cradled and rocked by the ocean lapping her island nest:
The sea and the stars strove together to speed her behest.

So, at her time of fructition Britain bore venturous sons;
Boats were their bulwarks and bridges under the thunder of guns:
Never the sea and its sailors Attila dared with his Huns.

Fleets of envious rivals strove for the Sea Queen's fall,
Pitting their power against Britain. But, ready and quick to the call,
Drake and Rodney and Nelson vanquished the foemen all.

Storms came out of the heavens to fling the Armada far;
The fame of the bold Dutch rovers paled 'neath the new-born star;
And the blood of the greatest sea-lord bought the triumph of Trafalgar.

Thus were the seas swept surely. . . . . Britain arose in her might,
Proffered the pledge of freedom to all she had flung in fight,
And a pass to the paths of the oceans, under her light.

Then did she send her children over the seven seas:
Speeded and swung to the far lands, each by a fateful breeze,
Heat could not conquer their courage, and frost could not freeze.

So did they mould fair cities; fashioned their rails and docks,
Girdled the earth with cables, lighted the oceans' rocks,
Peopled and pastured the prairies, and tended their droves and flocks.

Thus was the Empire builded, based upon Freedom's Chart,
Thus was a story written of trade and many an art,
And the fame of the Sons of Empire, dear to the Motherland's heart.

* * * * * * *

Over the lands and the waters floated a clarion call.
Britain, the Mother of Heroes, summoned her children all:
"Here are the Huns at my gateway! Help, lest I fall!"

Swift to the sudden summons brave Sons of the Empire sprang:
"We're coming, we're coming, Mother!" loudly the answer rang;
While the salt sea heard and echoed the song that the soldiers sang.

And now the Sons of the Empire will show to the watching world
That the cause of the Mother is theirs; and ne'er shall her flag be furled
Till the Huns from the gate of Britain back to the Pit are hurled.

STANDARD SILVER-LEAD MINING CO.

The following information relative to the operations in 1914 of the Standard Silver-Lead Mining Co., owning a group of mines situated near Silverton, B.C., and a concentrating mill situated on the eastern shore of Slocan lake at that town, has been obtained from the company.

Development work done during the year totalled 9,059 ft., this consisting chiefly of drifts and crosscuts, with a few raises between levels.

The quantity of ore milled was 44,806 tons, beside which there was mined and shipped crude 4,914 tons, together with 49,720 tons.

Average metal recoveries were as follows: From 4,714.47 lb. of crude silver-lead ore, an average of 49.17 per cent. lead and 86.65 oz. silver to the ton. From 4,154.47 lb. of silver-lead concentrate, an average of 65.75 per cent. lead and 103.31 oz. silver to the ton. From 5,618.50 lb. of silver-zinc concentrate, an average of 43.84 per cent. zinc and 35.23 oz. silver to the ton.

There was left on hand at the close of the year about 200 tons of crude ore of shipping grade, 1,300 tons of silver-lead concentrate, and 30 tons of silver-zinc concentrate.

No important additions were made to mine or mill plant and machinery during the year, both having been previously adequately equipped. An experimental unit of the Minerals Separation flotation process plant was put in but results were such as to lead to its abandonment.

Since the close of the year to which the foregoing particulars relate, development work has been continued in the Standard mine, and quite recently a crosscut was being driven from the raise that connects Nos. 6 and 7 levels, this constituting an intermediate level; No. 4 adit was also being extended. The Alpha mine, situated higher up the hill than the Standard, is being further developed by the extension of three of the adits opened years ago by the former owners. The work of driving No. 8 adit, which is on the old Emily Edith property, below the Standard, is to be resumed shortly. More men are being employed in the mines as work is advantageously found for them, and the concentrating plant is being operated one shift daily. Gradually mine and mill will be got back to work at full capacity.

HEDLEY GOLD MINING COMPANY.

A quarterly dividend of three per cent. and an additional dividend of two per cent. has been declared on the outstanding capital stock of the Hedley Gold Mining Company, payable Wednesday, June 30, 1915, to stockholders of record June 19, 1915.

CORRESPONDENCE

UNJUSTIFIABLE ATTACKS.

To the Editor of the Canadian Mining Journal:

Sir,—In the Coast cities of Victoria and Vancouver, British Columbia, persistent attacks have lately been made on Mr. Thos. Graham, Chief Inspector of Mines for the Province, and since the rules of the Provincial civil service do not permit of officials defending themselves in the public press, he is placed at a most unfair disadvantage. Now, since a number of newspapers have given publicity to misstatements and some have made serious reflections on Mr. Graham in regard to the way he has carried out his official duties, such reflections being based on false allegations, I ask you to be good enough to publish the following information, with the purpose of endeavoring to influence those who read it to suspend their judgment until such time as the findings of the Royal Commission lately appointed by the Government to make a thorough investigation of the circumstances surrounding the flooding three months ago of the South Wellington coal mine, on Vancouver island, and the resultant death of nineteen men, is arrived at and made known.

More than twenty years ago there was filed with the Department of Mines, Victoria, B.C., a tracing of a plan of the Southfield mine, then being operated by an Old Country company, whose engineers and surveyors followed the English custom of making plans on the scale of two chains—132 ft.—to the inch. In 1907 or 1908 a provincial syndicate or company undertook the development of a coal property adjoining the long abandoned Southfield mine. Its officials had free access to the tracing filed with the department and, as well, to the original plan in the offices at Nanaimo of the company that in 1902 acquired from the English company all its property in the Nanaimo district. Some years ago a law was passed in British Columbia requiring all coal mine plans to be on a scale of 100 ft. to the inch.

Mr. Graham took office as Chief Inspector of Mines on January 1, 1912, after having been for several years general superintendent for the Western Fuel Co., Nanaimo. The Coal Mines Regulation Act he has to administer, neither requires the Government mine inspectors to check up the surveys of mine operators nor does it give them power to do so under ordinary operating conditions. The responsibility for the accuracy of plans exhibited to the mine inspectors or filed with the department lies entirely with the operators. In the case of the South Wellington Company it is supposed that some one overlooked the difference in the scale of the old plan as compared with that of the plans of late years. This, however, has not yet been proved. In any case the mistake, if made, was not made by a Government official. This notwithstanding, a charge has been made by a lawyer, active in opposition to the political party in power in the province, according to reports printed in opposition newspapers, that the chief inspector brought into court two maps marked as on the same scale, when they were on different scales. As a matter of fact those maps were not produced by any Government official; on the contrary, the chief inspector had taken with him from Victoria to Nanaimo to produce at the inquest, if required, the tracing filed 23 years previously with the Department of Mines. Having at the outset of the inquest announced that it was the intention of the Government to hold a full investigation after a resurvey of the mine had been made, he did not think it necessary to call the attention of the jury to maps that were not official. So it is that the political lawyer, opposition newspapers (particularly the labor publications), and strikers who failed in their fight against the coal mine operators, have combined in their denunciations of the chief inspector, whom I believe to be the most efficient and thoroughly conscientious man available for the responsible duties of his office

To show the nature of the misrepresentation that has taken place, the following excerpts from reports of a Coroner's inquest are submitted:

From Opposition newspapers—

"Mr. Farris: 'You have known for over two months that the company had been working on plans drawn to different scales?' "

"Mr. Graham: 'Yes.' "

Mr. Farris: 'And when you posted up these two blueprints in court here, both marked 100 ft. to the inch, you knew that one of them was on a scale of 132 ft. to the inch?' "

"Mr. Graham: 'Yes.' "

"Mr. Farris: 'And you knew that everyone here in court was misled by that fact?' "

"The witness answered in the affirmative."

From sworn Stenographer's Report of Evidence taken:

"Q.: You knew this morning that the two plans did not agree, and yet you did not disclose it with us and the jury; how is that? What is your reason for not disclosing the difference between these plans—instead of leading us to believe they were the same?"

"A.: My reason for not doing so is because I did not see that it was necessary at a Coroner's inquest, since there will be another inquiry as soon as a re-survey is made."

"Q.: You think that is an obvious explanation?"

"A.: An obvious explanation."

"Q.: You intended to be silent during this inquest?"

"A.: I had no reason to bring it out."

"Q.: You thought it your duty as a Government official?"

"A.: Yes, sir."

The Vancouver Trades and Labor Council sent a delegation to the acting Premier of the province to ask for immediate removal from office of the chief inspector and that proceedings be taken against him for complicity in causing the deaths of 19 miners. These requests, pending the investigation of a Royal Commission, were refused.

Yours, etc.,

Victoria, B.C., June 1, 1915. E. JACOBS.

OSCEOLA.

The report of Osceola Consolidated for the year ended Dec. 31, 1914, shows net earnings of $352,586, or $3.66 per share, which compares with $381,967, or $3.97 per share in previous year. Production amounted to 14,970,737 lb. of copper against 11,325,010 lb. in 1913. Cost of production was 10.79 cents per lb. against 12.30 cents in the previous year; rock yielded 13.5 lb. refined copper per ton against 15.4 lb. in 1913.

GLACIERS OF THE ROCKIES AND SELKIRKS

By A. P. Coleman.

The traveler going westwards from the Canadian prairie finds the way blocked by a grim wall of cliffs rising 7,000 or 8,000 ft. above the sea and justifying the name of the "Rockies" given to our greatest chain of mountains. Toward the end of the summer these desolate precipices are snowless and except for a glimpse of white peaks through some pass there is scarcely a suggestion of the glacier region within. Then the train enters the "Gap" and before long the summits around show fields or patches of midsummer snow; and as one draws nearer to the heart of the Rockies there is blue ice to be seen clinging to the cliffs or reaching as glaciers down into the wooded valleys, and one is thrilled with the wild charm of alpine scenery.

However, engineers are strict utilitarians and always choose the lowest pass for a railway, so that the passenger in the observation car catches only tantalizing glimpses of the wonders and beauties of the ice world a few miles away and a few thousand feet above the valley. One must stop at some place like Lake Louise in the southern Rockies or Tete Jaune in the north or Glacier in the Selkirks to come into real contact with snow fields and glaciers. What a joy it is to get rid of the hot and dusty everyday world of cities for a while and come close to Nature in one of her wildest moods! It is not only the mountaineer who feels the seduction of the cool, clean solitudes where glaciers are born and do their wonderful work. Every healthy man or woman must yield to the delight of living in these inspiring surroundings.

It is worth while to put on warm strong clothes and hobnailed shoes and fill your lungs with mountain air in a scramble up to the snow fields to see how the glacial machinery works, machinery which some thousands of years ago shaped almost the whole surface of Canada, doing its work on the plains as well as the mountains and leaving it the splendid land of lakes and rivers and fertile prairies and rolling hills which it is to-day.

Snowline.—To reach the snows generally means some miles of walking and climbing, often, at first, through forest covered slopes, where the outside world is lost. Then the trees begin to thin and grow stunted, revealing between the trunks blue valleys with a lake or two and far off cliffs and mountains. At last the trees cease at 7,500 ft. and you are at timberline. Here the three Rocky Mountain heathers spread soft thick carpets between stiff bushes only a few feet high but with trunks a foot through, so buffeted have they been by the storms of centuries. The rows of dwarfed spruces leaning back against some rock ledge give fine shelter for the mountain goats, wisps of whose white wool cling to the stubborn branches.

Then come cliffs and rocky slopes and grassy or sedgy uplands (the true Alps as the word is used in Switzerland) where mountain sheep or goats pasture and wild flowers grow by the million, blue ones such as lupines, gentians, fox-gloves and forget-me-nots; yellow ones such as adder-tongues, columbines and a multitude of starry composite flowers; the red or orange Indian paint brush; and white flowers innumerable. You have reached the edge of the snow rapidly melting on a July day under a sun that is hot even on high mountains. The plants just freed from their winter covering are all bursting into bloom together, bees are humming, butterflies lazily flutter past and a humming bird poises over a blossom; for it is spring at these altitudes and there is a whole season's work to be done, seeds ripened and all, before autumn comes in September with its snowstorms burying all under the white silence of a nine-months winter again.

It is a thrilling experience to set foot at last on midsummer snow sweeping upwards gleaming toward the higher summits, snow that never entirely melts and that is so dazzling in the July sunlight that one needs dark or colored glasses to avoid snow blindness if the tramp is to be a long one.

We have no special word in English for these perpetual snow fields and so the French term *neve* is commonly used. Snowline is not nearly so definite as timberline and varies with latitude, exposure and snowfall. In the eastern Rockies of Alberta, where only a few feet fall in winter, the line is scarcely below 9,000 ft.; while in the western Selkirks, which catch the full brunt of the Pacific winds laden with moisture and have a snowfall of 40 or 50 ft. in a year, snowline is depressed almost to timberline, about 7,500 ft. This accounts for the bareness of the eastern Rockies as compared with the splendid Alpine features of the Selkirk range, which is the lower of the two.

While one gazes entranced at the array of lakes and valleys, of snowfields and dark cliffs, the wind rises and mountains to the west put on a cap of cloud. This grows and darkens and presently a mantle of mist sweeps up with the wind, the sun is dimmed and in a few minutes the wide world is shut out by a blizzard. We must make our way down to lower levels where sleet whitens the closing flowers, and then through a belt of rain swept hillside into the valley where the sun may still be shining hotly.

Since snow falls every month in the year on the *neve* fields and never melts away one might expect thte mountains, especially the Selkirks, to grow as snowheaps into the sky; but of course this does not take place. Under the increasing load of snow the lower beds are compressed into ice; so that the *neve*, beginning as loose or hard drifted snow above passes downwards into ice banded with blue and white layers, the whole sometimes hundreds of feet in thickness.

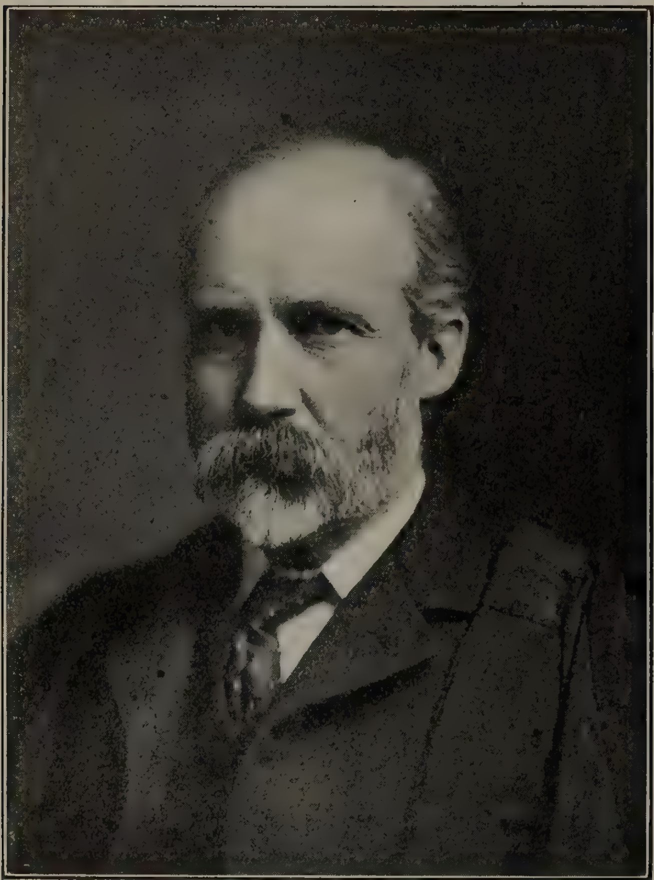
The snow accumulates only on the gentler slopes or in the higher valleys. On cliffs it cannot lodge but piles up on the *neve* beneath; and on steep slopes it may lie for a time but now and then, especially toward spring, it breaks loose and thunders down into the valley as an avalanche.

The Motion of Glaciers.—The final disposal of the snowfield, turned to ice in its lower parts, comes by a slow creep downwards. That the *neve* is actually in motion can be seen by following the slope of snow to its upper edge against some mountain wall where a *"bergschrund"* generally yawns between the snowfield and the cliff. This may be several feet wide and may go down many feet to obscure depths. No amount of snow can fill the chasm permanently, though it may be bridged with fresh snow for a time, making a risky passage for the climber.

The *neve* is always pulling away from the rocks at its upper border, and its general motion follows the direction of the lowest depression beneath, finally extending below snowline as a tongue of ice which reaches down into the valley until it is melted by the increasing warmth of the lower levels. Thus a glacier is born. Unless whitened by recent storms the glacier is bare of snow in summer with a rough uneven surface of a dirty

blue green color, partly covered with rocky debris, and its volume diminishes downward by thawing until at a definite point the whole is melted and flows away as a river of water instead of ice. The lower end is sometimes called the "tongue" or "snout" or "foot" of the glacier—a bad case of mixed metaphors.

Remembering that ice is a hard and brittle solid, it comes as a surprise to find that it can flow like a plastic body under the pull of gravity; but this can be easily proved. A row of stakes or of metal plates put across a glacier gradually gets out of line, the middle parts moving fastest as in a river; but the motion is very



A. P. COLEMAN, Ph.D.

slow, even in the middle, seldom more than a few inches a day in our mountain glaciers, though some of the great Alaskan and Greenland glaciers are reported to move several feet a day and in one or two cases as much as 60 or 70 ft.

At a sudden descent, where a river would leap as a waterfall, a glacier simply breaks across in what are called *"crevasses,"* fissures which may be several feet wide and hundreds of feet long, going down to blue black depths appalling to the inexperienced climber. As the glacier advances these crevasses are bent out of shape and may be crossed by fresh crevasses, splitting up the ice into wild lumps and pinnacles called *"seracs."* Seen from a distance across some valley such an ice fall looks like a cascade or a violent rapid covered with breakers. Below these steep descents the crevasses and seracs disappear by the pressure of the moving ice and the glacier becomes a solid mass again. Small glaciers hanging from cliffs may send down avalanches of ice which combine to make a lower glacier, the masses being welded together once more. It is evident that one cause of glacier motion is the power which ice has to break and then to freeze together again.

Since glaciers are often the easiest way up a mountain, climbing parties make use of them, starting at dawn so as to have a long day and following up the rough and rigid slope, zigzagging round crevasses and avoiding regions of seracs. Toward the upper end there may be fresh snow bridging the crevasses and the party should be roped together and travel in single file, the leading guide thrusting his ice axe into the snow at every step to make sure of safe going.

When the sun shines warmly on the glacier melting begins and water trickles down the ice ridges, and towards afternoon torrents of pale blue water are racing downwards in ice channels, here and there plunging into a crevasse. This becomes hollowed into a tube like the penstock of a water power and the foamy torrent springing into the blue chasm is called a "moulin," or mill. In this way the waters thawed from the surface reach the bottom and there roar along through an ice tunnel to the end of the glacier, bursting into daylight as a full fledged river.

Glacial streams are capricious. On a frosty morning scarcely any water flows and one can go far into the ice cave, but in the late afternoon there is a raging torrent loaded with mud and stones spreading into half a dozen channels on the broad floor ground. On a rainy or snowy day when the sun is hidden the glacial river almost goes out of business, but comes to life again when the clouds vanish and the sun shines. At those heights with a clear sky the heat of the sun may be intense though it is freezing a few feet away where some rock casts a shadow.

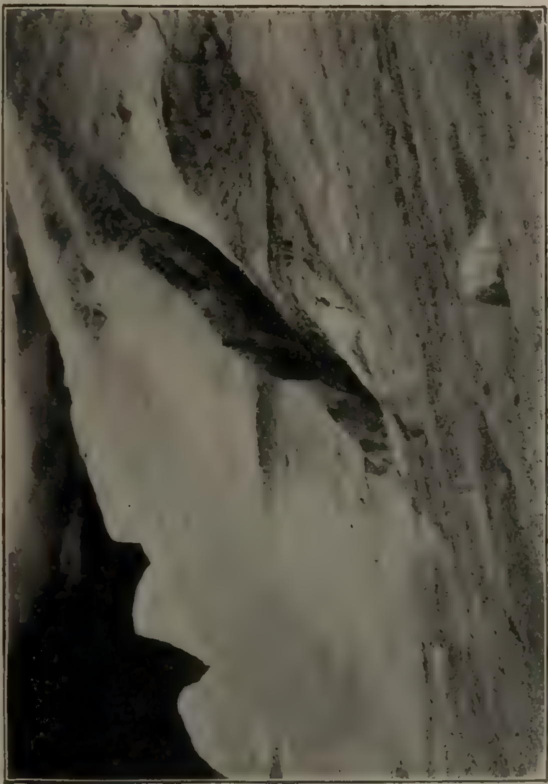
The Work of Glaciers.—One of the most interesting points in a glacier is its carrying power. Though it is in motion like a plastic substance it is solid and strong enough to support any weight loaded upon it. Debris quarried by frost from the mountain side buries its edge so that often one may walk 50 yards out before the ice can be seen. This fringe of broken rock carried on the edge of the glacier is called a marginal moraine. When two glaciers join, the marginal moraines between them unite to form a medial moraine, and when several tributaries combine to make a large glacier the dark lines of the medial moraines can be followed by the eye for long distances upwards to rocky peaks rising out of the *neve*, the source from which the train of rocks was derived.

Blocks even as large as cottages now and then roll down upon the ice and are transported without trouble. Medium sized blocks a few feet across called "glacier tables" are left standing on pedestals of ice, as thawing goes on all round them, since they protect the ice beneath from the sun.

The whole mass of stony material is carried steadily onwards until the end is reached where melting is complete and no more burdens can be borne. Then a terminal moraine is piled up, a steep and rugged crescent of loose blocks by no means easy to scramble over.

Work just as important is going on out of sight beneath the glacier, where fragments of stone frozen into the bottom of the ice form tools for gouging, carving and scouring the rocky floor, both tools and rock being ground up into the "rock flour" that makes the glacier streams so milky and opaque. The ground up material mixed with stones of all shapes and sizes without any assortment is left behind when the glacial thaws as "boulder clay." A little search in this clay shows stones with polished and striated surfaces, well worn tools, often called "soled boulders" and the rock surface beneath the boulder clay is seen to be rounded, smoothed and grooved in a very striking way.

The Retreat of Glaciers.—Our glaciers, like those of other countries, are now almost all in retreat, either



Crevasse on Great Glacier

Ice Bridge on Illecillewaet Glacier

Front of Tumbling Clacier on Berg Lake

because the climate is slowly growing warmer so that thawing goes on faster or because the snowfall is lessening so that the *neve* fields no longer feed the glaciers as substantially as before. On this account one can often see several terminal moraines down the valley below the one now forming. The nearest to the present end of the ice is almost bare, the next, a few hundred yards away, may have bushes growing on it, and others a mile or two away may be covered with ancient forest.

Glaciers once filled all the mountain valleys and even pushed out through the passes into the prairies and through the fiordes to the sea, for everywhere one finds boulder clay and moraines and valleys with U shaped cross sections that can only be accounted for by glacial action on a large scale. This work was done during the Ice Age, and one may truly say that the higher mountains are still in the Glacial Period.

One of the most beautiful results of former ice action is to be found in the "cirques," half Kettle or arm chair valleys, high up among the mountains overhanging the main valleys and enclosed by vertical cliffs on all sides except in front. These are the deserted nests of cliff glaciers, hollowed out by ice itself and often deepened so that a turquoise blue lake lies within rock rims. If not too high up these cirque lakes are surrounded by evergreen forest, behind which rise the grey or purple walls of rock with some snow in the ravines above, the whole mirrored in the lake, until some catspaw of breeze shatters the reflection. Lake Agnes in the mountains behind Lake Louise is an easily reached example of a cirque basin, and there are hundreds of others scattered through the fastnesses of the mountains, all gems in their way, many not yet seen by the eye of a white man. The higher cirque lakes, above timberline, enclosed only by cliffs and snow, have an austere beauty of their own, but lack the graces and the wild flowers of their sisters below in the forest zone.

Often the walls of such valleys are leaped by streams from some melting snowfield falling hundreds of feet and reaching the bottom as mere threads of spray.

Rocky Mountain Park.—There are very few parts of the world where fine glacial scenery can be found so close to a great railway as in our mountain parks. If one stops at Lake Louise, in Rocky Mountain Park, the splendid Victoria glacier is in view doubled by reflection in its waters, which get their exquisite color from the last remaining particles of mud brought down by the glacial stream. Two miles walk or ride along a good trail brings one into its presence, and often great masses of ice may be seen avalanching down from cliff glaciers above to the surface of the lower glacier. From Lake Louise as a centre one can reach the well named Paradise valley by ten miles ride or drive over a good road and visit the fine Horseshoe glacier at its head. The valley of the Ten Peaks farther to the southeast requires a somewhat longer ride or drive, passing the splendid front of Mt. Temple, the highest summit in sight from the railway (11,626 ft.). Moraine lake, eleven miles from Lake Louise, lies near the entrance of the valley, but farther up can be seen the great Wenkchemna glacier, and several small glaciers lying between the Ten Peaks. Beyond the Ten Peaks to the south there is a broad snowfield and glacier leading over to Prospector's valley and Vermilion Pass, but for an excursion of such length and difficulty one should be equipped for serious climbing and have a light camp outfit.

Crevasses, Glacier Southeast of Ten Peaks

From any high point west of Lake Louise one can catch glimpses of a much larger snowfield towards the north near Mts. Daly and Balfort, but the glaciers flowing from it are not so easily reached as those to the south of the railway.

There are glaciers in sight during most of the descent by rail from the summit of the pass through the wild Kicking-horse valley to Field, in the Yoho Park, from which the Yoho valley may be visited with Yoho glacier at its head. Descending beyond this into the warm depths of the Columbia valley the Alpine type of scenery is lost for a time. As the railway climbs

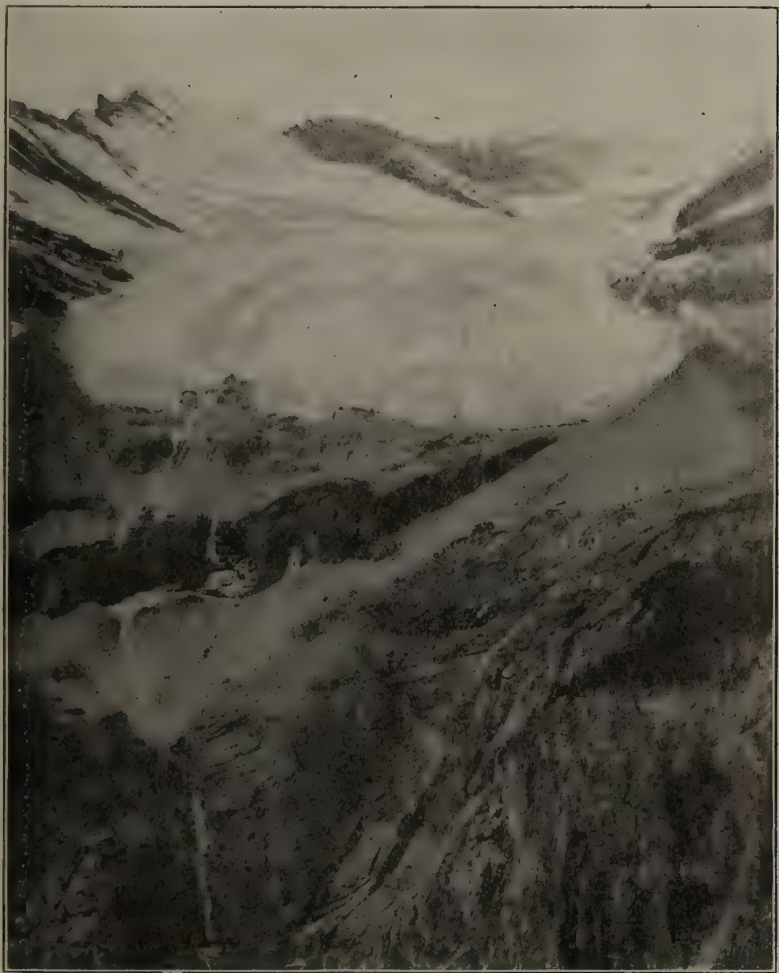
laboriously westwards out of the valley into the Selkirks, Glacier Park is entered. Here the scenery grows more striking until at Rogers pass one is once more surrounded by snow peaks—hidden, alas! too often by the long snowshed. The five mile tunnel now being pierced to avoid the heavy grades of the pass will cut out many a ravishing view of snow peak and ice tongue; but a stay at Glacier, just beyond the pass, gives an unrivaled chance to study a fine glacier with the least possible trouble.

The Illecillewaet or Great glacier is only a mile and a half from Glacier station, and as its foot may be reached with very little climbing, more travelers visit it than any other glacier in Canada. A climb to Mt. Lookout just west of the glacier gives a magnificent view over the Illecillewaet gacier and *neve* and over the grand mountains surrounding it. This region was the first part of our snowy mountains to be carefully explored and mapped by a skilful climber. The Rev. W. Spotswood Green made Glacier his headquarters for this work in 1888 and published his interesting book "Among the Selkirk Glaciers" in 1890.

There are still finer snowfields and glaciers in the little explored region to the north around Mt. Sir Sandford, the highest point in the range (11,634 ft.), though these are out of reach for the present; but any of the higher peaks near Glacier give a marvelous view over a wilderness of snow and ice broken by cliffs too steep for snow to lie.

Some of the lower points of the Selkirks, just west of the Columbia valley, though not more than 7,000 or 8,000 ft. in height, face the opposite Rocky Mountains with 100 or more glaciers in sight at once, the view beyond the wide and deep valley sweeping 150 miles of the main chain on its snowy western side. Unfortunately up to the present no path has been made to such a lookout point, and the dense forest makes the ascent difficult.

The greatest *neve* in Canada, so far as known, is the Columbia snowfield covering 100 square miles and sending tongues of ice down into a dozen valleys, but this is 80 miles northwest of Lake Louise and can only be visited with a camp outfit and pack train. Its northern limit will be within the new boundaries of Jasper Park and some day a good road will lead through the mountains past this splendid glacier region from the Grand Trunk Pacific to the Canadian Pacific opening up to the public the finest glacial playground in Canada.



Glacier on President Range, Yoho Park

The Robson Region.—The beauties of the Louise, Field and Glacier regions on the Canadian Pacific are well known to the public and have been seen by thousands; but the exceedingly impressive glacial surroundings of Mt. Robson near the Yellowhead Pass on the Grand Trunk Pacific have so far been little visited. Mt. Robson, rising 13,087 ft. above the sea, the highest point in the Canadian Rockies, is invisible, from the pass itself, hidden by the nearer Rainbow mountains; but bursts upon the view where Grand Forks river enters the Fraser. Only a few miles away at the head of the low valley its tremendous cliffs, mostly too steep for snow to lie, rise for 10,000 ft., crowned with a snowy pyramid. A trail leads up the Grand Forks through

the valley of a Thousand Falls where the main river tumbles 1,500 ft. in a wild canyon and reaches the rear side of Mount Robson 5,700 ft. above the sea. From some low mountains to the northwest there is perhaps the most splendid view in North America of mountains, glaciers and lakes. The blue seracs of the Tumbling glacier seem to be rushing down thousands of feet from the Helmet and the main peak of Robson to plunge into Berg lake, which doubles them by reflection. To the left the main glacier, starting in great icefalls on the northeast of the peak, sweeps a curve of five or six miles round the dark rocks of the Rearguard. Behind the main glacier toward the south rises the unbroken snow slope of Mt. Resplendent ending with a projecting cornice of snow at 11,000 ft.

The water coming from the ice caves of the main glacier flows chiefly into Berg lake and the Grand Forks, but a smaller part reaches lake Adolphus and Smoky river, a tributary of the Mackenzie river, the same glacier sending tribute to the Arctic and the Pacific Oceans.

There are other striking mountains in the region, such as Mt. Geikie to the south of the Yellowhead pass and the Whitehorn to the north, though none rival Mt. Robson itself; but much remains for exploration and it will be years before this northern region of the Rockies, all the Alberta side of which is in Jasper Park, is thoroughly known and mapped. Trails are being rapidly built in the park, however, and with the erection of hotels at Jasper and other points it will soon be possible for the Alpine climber and the tourist to find easy access to this delightful region.

Some comparisons.—Much of the exploration of the Canadian Rockies and Selkirks has been done by Englishmen and eastern Americans who received their training as mountaineers in the Alps, and one naturally asks why they should travel thousands of miles to our western mountains when the Alps are so much more accessible. There is, of course, the charm of a virgin and unexplored wilderness in our Rockies and Selkirks, so seductive to one who loves adventure; but there are other attractions as well which make our mountains fully the equal of the famous European range. Every type of Alpine scenery is as well illustrated in Canada as in Switzerland and the area of snow mountains in Alberta and British Columbia is several times that of the Alps. The whole length of the Alps is less than 400 miles and its breadth from 50 to 80, as compared with a length of 1,200 miles and a breadth of 140 miles for the Rockies and Selkirks, not to mention the Gold ranges, the Coast range and the Vancouver Island mountains, all of which have their snow fields and glaciers. Stuttfield and Collie in their delightful book "Climbs and Explorations in the Canadian Rockies" say of the Rockies that "they have a remarkable individuality and character in addition to special beauties of their own which Switzerland cannot rival."

Though there are higher mountains in the Rockies of the United States, they rise from a dry and lofty tableland and most of them have little snow and no glaciers. But for the row of extinct volcanoes beginning with Mt. Baker, Mt. Ranier and Mt. Shasta, the United States has very little truly Alpine scenery except where our Rocky Mountain ranges extend for a degree or two south of the boundary. A great many of the mountain climbers of the eastern States come to Alberta or British Columbia when they want to use an ice axe or a glacier rope and most of their experienced climbers are members of the Alpine Club of Canada.

Canadians themselves are often not aware of the splendid scenery and the unsurpassed opportunities for climbing of all grades of difficulty offered by their own mountains. There is no more exhilarating sport than that of the mountaineer, and there is no more interesting region for the geologist, the botanist or the zoologist than the grand ranges of mountains that run parallel to the Pacific in our western territory. While tourists from all over the world are being attracted more and more to our glorious alpine region it is especially important that our own people should seek a delightful holiday and gain health and vigor in our mountain parks. As good roads and trails and cabins for shelter are extended to the wilder and more impressive parts of the mountains it becomes easier for the ordinary visitor to study the sublimities of valleys, glaciers and mountain peaks once out of reach without an expensive camp equipment.

A few good Swiss guides are available at the more important centres in the mountains and the inexperienced climber should not undertake any difficult glacier work nor bad rock climbing without the aid of a guide. There is of course a wide range of less difficult walks and climbs that brings one without risk into the heart of the mountains where one may study the ways by which snowfields and glaciers and glacial rivers do their work of shaping the mountains.

The materials of engineering construction will receive special attention in the proceedings and discussions of the International Engineering Congress to be held in San Francisco, September 20-25 next.

The field will be treated under 18 or more topics, covering: Timber resources, preservative methods; brick and clay products in general; life of concrete structures, aggregates for concrete, water proofing, volume changes in concrete, world's supply of iron; life of iron and steel structures, special steels, status of copper and world's supply, alloys, aluminum, testing of metals, of full sized members, and of structures.

Some 25 papers are expected for this volume, prepared by authors representing five different countries. The list of authors includes many of the most eminent names in this field of engineering work throughout the world.

These papers, together with discussions contributed by leading American and foreign engineers, will be published as volume 5 of the transactions, and will be illustrated with charts, diagrams and half tones. The volume will form a most valuable acquisition to the library of all engineers and others who may be interested in these phases of engineering work. For full particulars apply to W. A. Cattell, secretary, 417 Foxcroft Building, San Francisco, Cal.

FIRST COAL DISCOVERED IN UNITED STATES.

Up to the present time the first mention of coal in the United States has been credited erroneously to Father Hennepin in 1689. The credit for this first mention of coal does not, however, belong to Hennepin, for the first discovery of coal in the country which afterwards became the United States was made by Joliet and Marquette in 1673. Joliet's map of 1674 shows the location of "charbon de terre" (coal) near the present city of Utica, Illinois.

In Coal Mining Practice in District 4, Bulletin 12, of the Illinois Coal Mining Investigations, by S. O. Andros, copies of Joliet's and Marquette's maps are published.

This district produces about 15 per cent. of the coal output of Illinois and has the best accident record of any Illinois district. About half of the accidents occurring in this district are caused by pit cars.

THE MINING ENGINEER*

By James F. Kemp.

I do not feel like a stranger in the Copper Region. Nearly thirty-two years ago my class in the School of Mines at Columbia was brought to Houghton and Hancock for six or eight weeks in the mines. My chum and I put in our days at the old Albany and Boston mine, which was later known as the Peninsula. But we also made the acquaintance of a "man-engine" in the Quincy, and saw the close and successful work being done on the low grade amygdaloid of the Atlantic. In the years since I have been once or twice with classes in Houghton and recall with great pleasure one long morning with dear old Dr. Koenig and his mineralogical treasures. To his memory, greatly treasured by us all, let me pay this little word of tribute.

JAMES FURNAM KEMP

All of us who are interested in mining and its fundamental science of geology must feel that Keweenaw Point is classic ground. We are reminded of the early expeditions of the French, in parties from the lower St. Lawrence valley, consisting usually of a missionary priest, of a gentleman adventurer and of comrades not adverse to trading with the Indians. Probably you all have seen in Foster and Whitney's Report the reproduction of the early map prepared by the Jesuit Fathers in the seventeenth century and sent back to France. Lake Superior, or Lake Tracey, as they then called it, is very correctly drawn as regards all its larger features, so correctly in fact, that our admiration is greatly excited by the close and accurate work of these "voyageurs," so many thousands of miles from home in the bleak wilderness. We read of their reports of copper among the natives and of the hopes of a mining industry in future years. Copper on Lake Superior and lead in southeast Missouri and in the Upper Mississippi valley were no small influences in the early colonial days. But who can say how far back prehistoric mining by the native tribes began, or how many centuries ago the blows were struck with those stone hammers which now from time to time we find on the outcrops of the lodes.

We people to whom mining geology means so much cannot be unmindful of the early work of the Foster and Whitney Survey, nor above all and in particular of J. D. Whitney's contributions, since he was the forerunner and father of us all here in America. I wonder if you have read the fascinating book of his Life and Letters, published within a few years past. In it we are taken behind the scenes and actually see the struggles of scientific men amid the forest trails of the Point and the storms on the lake. We sympathize with their lack of maps, as they tried to prepare a good and accurate description of the geology. Whitney was storing up experience and with the spirit of an apostle to the ignorant was preparing the data for his monumental work, "The Metallic Wealth of the United States." Among his countrymen, ignorant as babes of mining, he sought to spread in 1854 sound information regarding their material resources and the proper and reasonable development of them. While Whitney had done some youthful geological work in New Hampshire and had studied abroad, we can readily see that the main courses in the foundation of his later work were laid in the copper and iron regions of the Lake Country.

We have had another book within the last few years that is of unusual interest to all concerned with mining on the Point, and I doubt not very familiar to you all. It is the Life and Letters of Alexander Agassiz. In it we learn of the tremendous struggle which was undergone in the early years to place the Calumet and Hecla on its feet. Far be it from us who have seen the later prosperous days of this queen of copper mines to be unmindful of the heroic years which marked its development, or of the courage, faith, persistence and devotion which carried it through the initial stages.

I mention these qualities because they are characteristics which must be possessed by an engineer to a degree hardly equalled in the sister professions, and by the mining engineer pre-eminently among the different types of engineers. I wonder if you have ever thought of the contrasts which our profession offers to other branches of engineering. Almost all of our colleagues, civil, mechanical, electrical, are set to accomplish definite tasks. They build a railroad, design an engine, construct a dynamo or a power station. A problem in construction is theirs, and the elements of it are usually well known and definite. But we often have to discover and develop ore as we go along. We do not always know where it is ahead of us in the rock, or indeed if it is there at all. We are much more like the physician diagnosing an obscure disease. Our medical friend looks the patient over, learns symptoms, and infers causes. The X-ray photographs may help him immensely and give him a look at hidden organs or bones, but after all, he needs a peculiar and keen intuitive reasoning power that is a rare and very great gift. The medical schools prepare him not alone by information and disciplinary training, but also by

*Address to the Graduating Class of the Michigan College of Mines, April 15, 1915.

clinics, wherein he sees just such cases as he is likely to meet, treated by skilful men who may even give him bedside practice.

We mining people have to deal with cases of abnormal conditions in mother earth. We have to treat stoppages of circulation and their results, strongly analogous to varicose veins in the suman subject. We must now and then solve compound fractures and dislocations, not of a half an inch, as in bones, whose sundered ends cannot slip very far past each other, but of tens or hundreds of feet into the unknown. Comparing our work with the surgeon's, we have the one comfort that only in our imaginations do we have to put the broken parts back in their old, united positions. We may have only a little stringer to guide us, or the "trail" of the fault in a fault zone, or a slickensides, or a gouge of clay. In treating these difficult cases we must call to our aid all the lore or ore deposits. You remember how those old German mining geologists centering about Freiberg and Clausthal have written of the "Lehre der Erzlagerstatten," of the "Lore or Ore Deposits," and how we English-speaking peoples from the days of the old workers in Cornwall to the present have passed along with successive additions the accumulating experience of the past. Always in the back of our minds, for the ordinary run of orebodies we have the belief that some sort of solution has found a line of circulation and has brought in the useful minerals. We try to reproduce in our minds the way the old solutions behaved and to explain why they followed the special channels that guided them. We constantly seek the cause or conditions that made them drop their burdens of dissolved minerals at some places and not others. Sometimes an intersection of fissures may have led solution and precipitant to mingle. Sometimes an open-textured, relatively soluble rock may have itself served as precipitant. Sometimes loss of heat and waning pressure seem to have influenced uprising heated solutions, which Agricola nearly four centuries ago called the "juice of the earth," and which we often call to-day the "juice of the magma." These or similar questions are in our minds when one orebody is exhausted and we have to look for others.

Some orebodies resemble troubles in the human system for which the physician prescribes in the ordinary run of practice. But there are other cases which call for the surgeon. Let us suppose that our orebody is cut off by a fault; we need then to know how faults customarily move and how we may decide where to look for the lost continuation. What are the trail, the drag, the slickensides, the gouge, the fault breccia and what do they mean? What do our old-time authorities tell us—Schmidt, the Swede, and Zimmerman and V. Carnal, the Germans, and in recent years Freeland, our fellow countryman? We must not be too much taken up by the machinery used in mining and its enormous development in later years, and be unmindful of the old accumulated experience of the fathers gained in many years of laborious underground work. Hoover's translation of Agricola's Metallic Wealth has placed at the command of all English-speaking peoples a wealth of ancient learning brought together by Agricola about three hundred and sixty-five years ago. You would be surprised, if you have not read the book, to note on looking it through how much the ancients were like the moderns, and how very acute they were in their observations and inferences. Even our devices for hoisting, pumping and ore dressing are foreshadowed in Agricola's pictures. The miners and metallurgists of his day had no steam power, nor did they understand chemistry as based on the atomic theory, much less the doctrine of ions; but they utilized the forces at their command with rare skill and they usually left singularly clean slags, when they had reasonably simple ores to smelt.

But I did not mean to digress too far in speaking of our predecessors nor to do more than to urge you to hold them in grateful and appreciative remembrance. We are living in the present and after the preparation in the professional schools we each have a man's work to do in the world.

In all our schools we have professors of the various sciences and of the arts involved in mining and smelting, and yet there is one professorship which we do not have, despite the fact that we might almost think it the chief chair of all. I have in mind a chair of that indefinite thing or body of personal experience or attitude of mind towards one's fellows and associates which we sum up in the term "Life." You see we are not machines whose horse-power can be calculated and which run on their monotonous round until they wear out. Back in the late eighties I passed five very happy years in the faculty at Cornell. My old friend and older colleague, Professor R. H. Thurston, the director of Sibley College in those days, used to rather enjoy defining a man as an engine who could consume a certain amount of fuel under his boiler and deliver a certain amount of work from his muscles and brain. But we know very well that this is only a half-truth. A man has a personality, a spirit, a disposition, a character, a sphere of influence, that are quite distinct from the number of shovelfuls of ore that he can heave into a car if he is mucking, or the numbers of traverses he can turn off if he is surveying. It makes no difference to an engine whether its nearest neighbor is ten horse-power or ten thousand, or whether it has a cut-off or a simple slide valve, or whether it was built by Nordberg or Leavitt or Lidgerwood. But it makes a world of difference in a community of people whether a man in power is considerate, just and sympathetic; or whether he is unscrupulous, selfish and faithless. Or whether again he who is a leader is easily discouraged, or is disposed to lie down on the job, shirk responsibilities and take duties lightly. All these matters are of exceptional importance to a mining engineer, who may as he gets on in the profession be not only in charge of the technical work, but if he is in a remote community, may be mayor, board of aldermen, school commissioner and provider of food and clothing.

In the summer of 1910 the eleventh International Geological Congress was held in Stockholm, Sweden. Our good friends in Sweden planned an excursion for the visiting delegates, which would take them northward through the most interesting of the pre-Cambrian exposures and would let them see the great iron mines at Kiruna, then under full headway, although about one hundred miles north of the Polar Circle in Lapland. You may not all know that you can travel every day of the year in a good standard gauge train, with sleepers and diner, from Stockholm north to far within the Polar Circle, and come out at Narvik on the coast of Norway, where the harbor never freezes. We delegates to the Congress found ourselves one day in Kiruna. We were conducted along several miles of outcrop of a great sheet of extremely pure magnetic iron ore with a general average of one hundred and fifty feet in thickness. The ore forms the backbone of a high ridge, but it is fully six hundred feet from wall to wall, where the ridge falls away to a cross

valley and lake. On this broad end the chief mining is being done in terraces. The ore is generally believed to be an igneous sheet. Many who have seen it consider it the largest single mass of iron ore yet discovered. It is, moreover, very rich in iron, although also high in phosphorus.

The development of this ore body is chiefly due to one man, Mr. Hjalmar Lundbohm, formerly a member of the Swedish Geological Survey, and for many years a good friend of not a few of us here in America. Mr. Lundbohm is now the chief official in the company, which in good years ships four or five millions of tons of ore. For several years he had saved the very peak of the orebody to be blown down when the Geological Congress should be his guest. And one evening about nine o'clock, but in daylight as bright as noon, while we were having coffee on the lawn before his house, perhaps half a mile from the peak, President Van Hise of the University of Wisconsin pushed the electrical button and caused twenty or thirty thousand tons of ore to fall with a crash.

At noon, however, we had lunched on this very summit and for a little while I had sat down somewhat apart from the rest and had studied over the bleak expanse of lake and bog and low glaciated hills which stretched away from the foot of the ridge. Under ordinary conditions only Laplanders with their herds of reindeer could eke out subsistence in the land, and yet below me was a little city of eight or ten thousand souls. There were a thousand children in the schools. The long night of winter had to be overcome with light. The polar cold had to be fought with fuel, and the nearest coal is in England, or in Spitzbergen, where lately Mr. Scott Turner, one of your own graduates, has been developing it. I looked over Kiruna and thought of the manifold responsibilities which centre in Mr. Lundbohm, and how in other places the manager, or as you say on the Point, the agent of a mine, is the head of a little state. I could not help feeling that there are other sides to the profession than ore and rocks, sinking, stoping and concentrating, oil flotation and smelting. There is the care of men, women and children, and the oversight of their manifold needs and general good. Yet what I saw at Kiruna, Lapland, impressive because so far in the frozen north, could in earlier years be duplicated right here on the Point and in the iron ranges, and doubtless can be yet. In the little settlements of the West there are many cases where a mine supports an entire community, and as for Mexico and South America, any one of us of wide acquaintance can cite graduates of our mining schools who bear the same relations to their villages and towns that Hjalmar Lundbohm bore to Kiruna. He had established at Kiruna, with a singularly generous spirit, schools of the very best character, with cheery pictures on the walls and with the best of desks and apparatus. Comfortable homes were provided for the miners and their families and much kindly attention was given to matters of welfare.

Yet with all these provisions for material and intellectual welfare, there is one other side which we cannot overlook, and that is—amusement for idle hours. We never trouble our minds about a man when he is busily at work, but we are justly concerned about him when his day or night shift is over. For miners who are underground during their working hours in dark and often wet stopes and drifts it is of more importance than for other workers to have some sort of wholesome recreation available whereby to pass an enjoyable evening. If, as we all have seen in little remote settlements, there are only the boarding house and the bunks, we will find the miner storing up his craving for a change until the end of the week or month, and concentrating in a short, wild period what should have been taken in diluted and harmless instalments over days and weeks. The Young Men's Christian Association is taking up the matter vigorously and agitating the establishment of club houses which will supply social centres, often in charge of a specially qualified worker. In the American Institute of Mining Engineers we have during the past year been lending a very sympathetic ear to one of our officers, Fred Rindge by name, and an engineer by training, who is specially looking after the work in the mining communities. You will find in the papers of the last annual meeting a contribution by J. Parke Channing strongly favoring the movement.

And yet we must undertake these welfare movements prepared to be misunderstood and to find our best intentions regarded at times with suspicion and disfavor. Experience leads us to expect it, but we must be strong enough, and far-sighted enough, and persistent and unselfish enough to work discreetly and wisely for the good of a community depite the rebuffs.

I have endeavored to draw, and I hope you will feel with some justification, the parallel between the mining engineer and the physician. But there are other features of a mining engineer's work which we must not overlook. He is a sort of combination of overalls and dress suit and he has to be equally at home in either. He must put on the former if he is to know both what lies underground and what goes on underground. Several years ago I was out in Butte one summer with H. V. Winchell, one of your old-time Lake Superior men, and J. W. Finch, of Denver. We were looking over the geology of the Steward mine with great care. Now in the fault veins at Butte, through which, as channels, have certainly coursed great flows of hot waters, a soft clay gouge is very abundant. In old and wet workings it makes an emulsion or a thin syrup of fine particles that is first cousin to paint. We three had crawled through the old drifts of this character all day and had come up about four-thirty in the afternoon, so as to step off the cage just as the "Seeing Butte" car had deposited its load of eastern schoolmarms and various other kinds of tenderfeet, all in charge of an orator with a megaphone. The Steward was the mine to which they were customarily taken. "Ladies and gentlemen," said the orator, "this is the Steward mine where many of the wretched miners work far underground, whose little cabins I showed you out on the flat. It is wet and dirty underground and—" catching sight of us, "there's three of 'em now." We certainly looked the part and tried to keep straight faces until we could slip into the change house.

What we had seen, however, embraced three sets of remarkable faults, which had developed one after the other. We had seen the oldest vein displaced by the next, and it shifted off one side by the last. We had been so keen in the study of this geological structure that I do not believe it had occurred to one of us that our surroundings were wet or dirty. As my colleague in mechanical engineering at home once said in my hearing, "When we are working over an engine in our overalls and in the grease and heat, we never think of either of them. It's the idea that fills our minds. The design or plan that makes the engine go excludes all else." And so it is with us amid the discomforts of

the work, if we may call them so. We forget them, our minds are so filled with the systematic attainment of results or with the study of the geologic structure of the veins, or with the forecasting of what will happen to our ore on the next level, or with the needs of the community of workers, or above all with satisfying the board of directors on whom, back in the central office somewhere, the manager must always have a wary eye.

With the last consideration, the dress-suit side of the profession comes in. Not only must our man in authority look out for his miners, but he must be just as ready to meet his directors on equal terms. He may live most of the months in the remote community, but with the revolving year comes around the time of annual reports, of conferences, of presenting in person the results of operation; it may be also of hospitalities extended and social courtesies, of meetings with the Institute of Mining Engineers and mingling with one's fellows. And then we have to shed the overalls in favor of the dress suit. One must guard against too much overalls, and not let the stiffly starched bosom choke too hard at the neck because of disuse. Some young engineers are a little inclined to overdo the overall phase of the profession, whereas we should be good companions with all sorts and conditions of men.

Commencement is a time of changes and of breaking old ties and associations. Perhaps you will not mind, if, as one not too far removed from his own experiences of the same sort, I touch upon them for a few moments. I am moved to do so from another bit of experience that was gained in those years at Cornell, earlier mentioned. It was the university's custom to have a Sunday afternoon sermon in the chapel. The most eminent ministers available were invited to preach. Now as we faculty people listened to the sermons Sunday after Sunday we could see that almost always the clergyman said to himself: "I am going up there to address a university community. I must prepare a careful essay on the problems of modern philosophy or science or human destiny. I must not disappoint that audience or fall below its expectations." But had we been given the opportunity, we university people could have said to him: "My dear man, we have all those themes six days in the week in the class room. Sometimes we like to forget them." One afternoon there appeared in the pulpit a clergyman from Louisville, well along in years. With no evidence that he was making the supreme effort of his life, he talked to us in a kindly pastoral way of the experiences which fall to the lot of every one of us. He obviously was animated by love of his fellow man and what he said came naturally and was welcomed in full measure by those who heard him.

I am far from being able to speak from any such ripe experience or in any but small degree to take the same position. We engineers, moreover, are men of quasi-military training, and we have a haunting dread lest our emotions get the better of our judgment—lest in moments of excitement or lack of attention we read our transits or compasses wrong and make a mistake. In engineering, whatever else we do, we must not make mistakes. Too much depends on our being right. Nevertheless, we can talk over the things that fall to the lot of us all.

To my mind the most trying time with all of us is at the start. Almost every young engineer has several unsettled years before he finds a permanent place. While this experience is not invariable, it is the rule. The entrant into the profession is getting experience and is taking a course in that subject of "Life" for which we have not and cannot have a professorship. In the long run, however, all the years total up their contribution to the final result and most men of maturity are loathe to admit that any of their experiences have been without final use. It is not a bad plan for a young engineer to look himself over and see what value he would really place upon himself to his company. It takes time to get broken in and to learn the routine. No harm is done in assuming the employer's point of view and seeing if, with conditions reversed, we ourselves would give any more for the service. Every one and especially the beginner may properly wish to give full equivalent for compensation received. A subordinate may often wisely in his imagination put himself in the position of his chief, live his daily round, think over his responsibilities and harassing cares, and then see what can be done to make them a little less burdensome. Most of the men whom we know, partly from individual characteristics, partly from the pull of outside influences, come to revolve in fairly definite orbits. If we secure and use a sufficient number of observations, we can calculate a particular orbit, just as do the astronomers in dealing with a planet. We can with a little study and foresight know where to find our man at different times of the year and under the circumstances produced by any conjunction of known forces supplied by outside influences. Can a junior thus forecast what his chief will need and be unostentatiously ready, and can he avoid asking too many pestiferous questions of a busy man, he will certainly secure the appreciative gratitude of his chief. Let me whisper to you that even among professors often kept under keen nervous strain by the demands of classes and by the consuming desire to have their subjects understood by the young people before them, the foresight of an assistant who knows where all the specimens or apparatus are that are to be used in illustration and has them ready without undue oversight, comes as balm to excitable nerves.

Work after leaving the engineering school is on the whole rather less difficult than the exacting requirements maintained by our good institutions. There is less variety but more intensive effort of the same kind. The young engineer often misses the keen intellectual stimulus provided by his association with his classmates in the courses. He finds that his work calls less for the full exercise of all his powers. Once some years ago I made a quick trip to give a little lecture on gold mining in a course before the university and townspeople at Evanston, Illinois. Hastening home for my classes, I sat down in the dining car opposite a man whose appearance attracted me, but to whom with the foolish diffidence of Americans generally I was afraid to speak. Europeans can give us a few useful points in these respects; for on the other side, if two strangers find themselves seated at a small table together, they will at the very outset very often exchange cards and chat pleasantly together. Well, we two on the diner eyed each other out of the corners of our eyes, each afraid no doubt that the other would sell him a gold brick if he opened up an acquaintance. Finally my neighbor passed me the salt and we fell into conversation. Once started we had so much to say that we talked half the night. He proved to be a graduate of the Rensellaer Polytechnic Institute, the earliest of our engineering schools in America, and the great mother of civil engineers. He had gone into the iron

business and had served his first apprenticeship on a blast furnace. Once the furnace was tight and was not running well, so that all hands were on duty thirty-six hours at a stretch. The general manager of the company, who knew him well, came around and said to him, "Well, Jack, I guess this is something different from your old college days." "My dear sir!" said Jack, "this is child's play compared to what I have been through in the engineering school." He was right. When examinations in subjects involving applied mathematics, or in branches of science calling for exact knowledge, or the preparation of graduating these, geological reports, and experiments with pumps and dynamos roll upon us, we are being prepared to find the demands of later work seem comparatively simple.

No one who knows our engineering schools can have any doubt whatever that our courses in applied science are preparing for later life hard-working, earnest men who simply cannot be discouraged and who stand up to the calls made upon them like good soldiers. I doubt very much if, on the whole, you will find later work as difficult as many situations in the professional school.

But in some ways conditions are different in actual practice. In the professional school it is a fair field and no favor. A very just set of judges on the whole give the faculty's decisions. But in actual practice self-interest counts for more; family influence, the influence of property, and the various other factors enter. Questions of right and wrong are less prominent than in college life. Conditions are more selfish, and often bring disappointment and injustice.

But you must be strong enough not to be soured by such experiences when they come. You must be big enough not to mind them, but to keep your own attitude toward life as much as possible a generous and helpful one. One summer I was called to Nova Scotia and I sailed across from Boston to Yarmouth at the southern end of the peninsula, and rode on the train through what the railroad folder called the land of Evangeline. My neighbor in the seat and I fell into conversation. He was a graduate of one of the largest and best of our eastern technical schools, and was then employed in some important works in Providence. Obviously he was not getting on badly, for he was off on a vacation trip with his little family. Yet his earlier experiences had evidently soured him, for he said, "I'll tell you the proper preparation for business. It is not a college or technical education, but the life of a newsboy or bootblack, who knows everybody's hand is against him and uses his hand against everybody. The newsboy has cut his eyeteeth." That attitude is not the true one. We have, to be sure, our hard experiences and our discouraging ones, but we do not knuckle under for all that. On the contrary, we forget them as soon as we can. When the umpire roasts our team in one place, we lose the game and are sore over it for awhile; but the next time we will be playing somewhere else and the umpire will be different. Experience shows that sooner or later all the good, strong, well-qualified men win out, and getting free from the ruck become reasonably well established. Then through our local engineering societies, such as the Lake Superior Mining Institute, or through our national society, the American Institute of Mining Engineers, or the Mining and Metallurgical Society, or in other ways, come our professional associations and friendships which are altogether delightful. They are well worth much patient and dogged endurance at the outset.

On bestowing a degree in medicine it is the custom, as you doubtless all know, for some older member of the profession to administer the oath of Hippocrates, a very ancient ritual which has been observed for quite two thousand years. Many times at commencement at home we have seen the group of young physicians stand while they were reminded of the pledge which had come down through the long line of centuries, so long in fact, that the very gods by whom the early Greeks made affirmation have passed away. Each man is adjured to swear by whatever he holds most sacred to practise his profession in honor and uprightness, to be always ready for the call of the sick, to enter no man's house other than to bring the acts of healing, to never perform, much less suggest, a wrong, to keep inviolably secret what is learned of the lives of men. Many times amid a solemn hush I have heard the senior professor in the medical school conclude: "And now if you observe your oath may success and prosperity attend you; the opposite if you shall prove yourself foresworn."

In engineering no ancient pledge has come down to us from Archimedes, our great forerunner,, nor from those master minds which built the pyramids or laid out the great systems of irrigation in the valleys of the Tigris and Euphrates. Our profession, distinctively named, is of comparatively modern date. Yet mining is a very ancient art. We do not know when the first rush of placer miners to some new productive diggings took place; but the myth of the Argonauts and the Golden Fleece reminds us that there were such expeditions. We do know that the Assyrians fought with the Egyptians for the copper mines of the Sinatic Peninsula which separated them; that Athens was the leading state in Greece because of the lead-silver mines at Laurium, its seaport, whose ancient slags are now being reworked by the French; that Hannibal, said by H. C. Hoover to have been originally a mining engineer, fought the Romans for the copper mines of Spain; and so on through the centuries.

While we have no Hippocratic oath, we must feel the force of the traditions of a calling that is very old. We must realize, too, that when a man has completed a severe course of training, and has his name added to the alumni list of a professional school of high character, he has given pledges for straight dealing and true speech for all the remainder of his life. The graduates of our engineering schools feel this just as do the graduates of the Military Academy at West Point. And rarely in the former as in the latter, do we find in the long list of names and professional service, the records of those who have been actuated by other than high professional standards. Graduates have in their keeping not only their own reputations, but also the reputations of the schools wherein they have prepared for special service. No appeal for straight conduct and true speech could be stronger.

And now when Commencement is over and you are out in life you will all miss the fellows and the old associations, but while not permitting the old ties to diminish in strength, you must be prepared to make new ones and find friends wherever your work takes you. You must enter into the life and interests of the communities where you will finally settle, and find in them the satisfying of the craving for sympathetic companionship which all of us gregarious beings feel. From time to time come class reunions and alumni

gatherings and the renewal of old associations. I doubt not you will always turn with affectionate remembrance to your years in your alma mater and think kindly of the nights when you fell asleep while the Ball and Nordberg stamps beat time for the deep bass lullaby of the Copper Country's mills.

FUEL OIL IN UNITED STATES NAVY

By Admiral H. I. Cone.

The fuels used in the U. S. navy are coal, fuel oil and gasoline. Coal must have certain characteristics to make it suitable for naval use. One of the most important strategical requirements of a warship is her ability to steam great distances without recoaling. Another is her ability, in time of need, to make high speeds. As both bunker capacity and boiler power are limited by other features of design, it follows that the coal must have the greatest thermal efficiency obtainable in connection with the other necessary characteristics. High volatile coals are usually very smoky in naval boilers. Smoke not only reveals the location of the fleet, but might fatally interfere with accuracy of gun fire.

The advantages of oil as compared with coal are:

An evaporation per pound of fuel in the ratio of about 14 to 9, and per square foot of heating surface in about the ratio of 10 to 8. Fuel can be taken aboard more rapidly without manual labor, and without interruption to the routine of the ship. The problem of fueling at sea is solved. Steam for full power can be maintained as readily as for low power. A vessel burning oil is capable of runs at full speed limited in duration only by the supply of fuel. There is no reduction in speed due to dirty fires or to difficulty in trimming coal from remote bunkers, or to exhaustion of the fire room force. There are no cinders and the amount of smoke can be controlled. A considerable reduction in personnel is possible. The weight and space required for boilers is reduced. First, by the reduction in heating surface required, and second by the shortening of fire rooms. Consequent on the reduction in heating surface is a decrease in weight and cost of boilers. Coal and ash handling gear is eliminated. This renders unnecessary the piercing of the hull for coal trunks and discharges from the ash expellers or ash ejectors. The stowage and handling of oil is much easier than of coal and will result in a much cleaner ship with consequent increase in time available for drills. The mechanical supply of fuel to the boilers gives a prompt and delicate control of the steam supply, permitting more sudden changes in speed than with coal, which is a tactical advantage. The nature of fuel oil permits utilization of remote portions of the ship and of constricted spaces for its stowage.

These advantages have long been recognized by the U. S. navy, and there have been experiments with liquid fuel dating as far as 1867. All these experiments have confirmed our belief in the considerable military advantages which will accrue from its use, but until recently it has been impracticable to use it extensively on account of the uncertainty as to the adequacy of its supply and the sufficiency of its distribution among the seaports of the world. We are now assured, however, as regards the supply, that there is sufficient oil on the public lands of the state of California alone to supply all probable naval demands for one hundred years should oil be burned to the exclusion of coal, and of course there is considerable oil in other portions of United States territory. The question as to the distribution of oil among the ports from which fuel might be required by our vessels in time of war is one that is well within our power to solve, as from its nature the oil can be transported and stored more easily than coal. Indeed for transport of oil in time of war we are already better provided than for coal, there being a large number of tank steamers flying the American flag. Oil is therefore certain rapidly to replace coal as a fuel for navy purposes.

Since 1907 all torpedo boat destroyers contracted for, of which there are twenty-nine, burn oil exclusively, and the battleships "Delaware," "North Dakota," "Florida," "Utah," "Wyoming," "Arkansas," "Texas" and "New York," contracted for during this period, are fitted to burn oil as auxiliary to coal, each of these vessels carrying about 400 tons of the liquid fuel to be burned at full power after the coal fires become dirty, or when it becomes difficult to trim coal from the bunkers in the fire rooms. In the case of these battleships the advantages of the oil have so appealed to the personnel that oil alone is burned to a great extent in port, and to some extent while cruising, although the installation of the oil burning equipment did not contemplate these uses.

The "Nevada" and "Oklahoma," the two battleships which have recently been contracted for, will burn oil exclusively. This is perhaps the most radical development in naval engineering since the advent of the turbine. It has permitted in the case of these vessels a reduction in boiler weights, which has made possible the use of heavier armor than has hitherto been employed. The reduction in length of boiler compartments has permited the grouping of all boilers under one smoke pipe, which course clears the upper deck considerably and permits more extensive arcs of fire for the turrets.

Aside from the use of oil as fuel under steam boilers, it now seems probable that within comparatively few years oil used in internal combustion engines will furnish the principal fuel for all naval vessels. This is in consequence of the recent remarkable development of heavy oil engines of the Diesel type in Europe. Hitherto, oil engines have not merited much consideration for large naval vessels on account of the limited power that could be developed in a single cylinder. An installation of any considerable power required a multiplicity of cylinders. Now, however, we are credibly informed that 1,000 horse-power has been developed in a cylinder about 33 in. in diameter with a 40 in. stroke, at 150 revolutions per minute in a two-cycle marine type readily reversible engine. This engine has a speed control that is satisfactory, and an economy of fuel consumption probably twice that of a steam engine.

In the United States navy heavy oil engines built or so far projected are limited to a number of submarine vessels and to mother ships for submarines. The former develop 1,200 horse-power, distributed between two shafts, the latter 900 horse-power on one shaft.

Gasoline is used as fuel for all of our earlier submarines and for a large number of small power boats

*A paper read before the Eighth International Congress of Applied Chemistry.

carried by warships. Its use is likely to be discontinued entirely as soon as suitable heaviy oil motors for the small power boats are developed. As stated above heavy oil engines are already supplanting gasoline engines in submarines.

The United States navy has at Philadelphia a fuel-oil testing plant where all grades of fuel oil are tested, many different designs of burning apparatus, different heaters and different forms of air admission are maintained. Actual use aboard ship indicates that about 200 gallons of oil is equivalent in power to one ton of good coal. That is not quite five barrels. In actual heat units a pound of fuel oil contains about 19.500 British thermal units, the navy standard steaming coal runs a little over 14,500.

Oil used on the east coast comes from Oklahoma and Texas. However, experiments at Philadelphia show very little difference in steam production between oil from different parts of the country. There is one thing—navy fuel is not permitted to have a flash point below 150 deg. F.; that is, on a closed cup, whereas in locomotives, in power plants, and on some merchant vessels, California crude is used, and a large amount of Mexican crude, where the flash point might be lower than 150 deg. So that fuel oil for the navy is oil that has been subjected to some refining treatment, and had the lighter and more volatile products removed.

COAL MINE DISASTER ON VANCOUVER ISLAND, BRITISH COLUMBIA.

Twenty-two miners lost their lives on the afternoon of May 27, when an explosion occurred in the Western Fuel Co.'s Reserve mine, situated about five miles from the company's shipping docks at Nanaimo, Vancouver island, British Columbia. As the mine is a comparatively new one, it has not yet been extensively opened, so the number of men working in it was not large—only 36 at the time of the disaster, and of these 13 were rescued uninjured and one, who though badly hurt, is likely to recover.

The cause of the explosion has not yet been ascertained. The Provincial Department of Mines has commissioned Mr. James Ashworth, of Vancouver, B.C., a coal mining engineer of lengthy and wide experience, to make an investigation. Mr. Joseph G. S. Hudson, of Ottawa, of the Explosives section of the Canada Department of Mines, and Mr. Thos. Graham, chief inspector of mines for British Columbia, are also at the mine.

The Reserve mine is near the centre of a 2,500 acre virgin coal field in Nanaimo and Cranberry districts; it has been opened by two shafts, main and auxiliary, 350 ft. apart, dimensions 10 x 26 ft. inside of timbers. In April, 1913, a 10 ft. seam of coal was reached at a depth of about 1,050 ft. The development of the mine was delayed by the strike of coal miners on May 1, 1913, and it was not until 1914 that much progress was made toward opening the coal. The mine equipment—machinery and plant, fan, etc.—is modern, and all plans are for an eventual production of 1,500 to 2,000 tons of coal a day. Approximately $750,000 has been expended in developing and equipping the mine and in construction of a standard gauge railway from mine to shipping docks.

MINING ROYALTIES AT COBALT*

By A. A. Cole.

As there appears to be some misconception as well as lack of appreciation of the reasons for the royalties payable by certain mines at Cobalt, the following explanatory notes may be of interest:

When the Timiskaming & Northern Ontario (Ontario's Government railway) was started, the Government placed the management under a Commission. The railway was granted a right-of-way and also certain townsites along the line of location. Later on the Government also granted to the railway the minerals underlying the right-of-way and under the townsites except where these had already been disposed of. In the vicinity of Cobalt these mining rights proved very valuable both in the case of the right-of-way itself and also under the townsite.

Instead of undertaking mining operations itself the Railway Commission divided its mining lands into convenient lots or parcels and leased them to companies or individuals, who acquired them by public tender. In this way the following four leases have worked and made returns to the railway:

The Cobalt Townsite Mining Company, The City of Cobalt Mining Company, The Right of Way Mining Company, The Nancy Helen Mines, Limited.

The company acquiring a lease paid a cash bonus to begin with and thereafter a royalty on shipments. Originally the royalty was based on the value of the ore at the collar of the shaft, but this was later changed to a percentage of the net profits.

The policy of the Railway Commission has been to assist the lessees from time to time by a gradual reduction of royalties as the resources of the mines were exhausted. This has worked out in a satisfactory manner both to lessor and lessee.

Each lease started out by paying 25 per cent. royalty on the value of all shipments at the collar of the shaft, with the one exception of the Townsite Company, which was supposed to pay 50 per cent. royalty on all ore assaying over $1,000 per ton, and 25 per cent. on ore assaying lower than that amount. This was early considered unsatisfactory and a uniform royalty of 25 per cent. on gross value was adopted. The next reduction was to 25 per cent. net, or to be more explicit, 25 per cent. on profits calculated as in the Supplementary Revenue Act (now called The Mining Tax Act).

The further successive reductions have been to 20 per cent., 17 per cent., 15 per cent., 12½ per cent., 10 per cent., and 7½ per cent. On July 1st, 1914, all leases from the Railway Commission were reduced to 7½ per cent., and the agreement now stands that this will be the royalty till September 1st, 1915, on which date all royalties will be reduced to 5 per cent. on profits.

By the above leasing system the lessee only pays a royalty on ore recovered. The fairness of this system, particularly to the lessee, may be illustrated by the following example.

To the south of the Town of Cobalt there are two lots of approximately 40 acres each, the Silver Queen and the Cobalt Townsite properties. In 1906, when Cobalt properties were coming prominently before the public, the Silver Queen property was part of the holdings of the Hudson Bay Mining Company, while the Cobalt Townsite property belonged to the T. & N. O. Ry. These two properties lying side by side each had silver-bear-

*From report of the Mining Engineer of the T. & N. O. Ry. Commission

ing veins exposed on the surface and similar geological conditions. The ore exposed on the Silver Queen was richer than that on the Townsite, but the area of silver-bearing formation was more restricted on the Silver Queen property, so that a comparison of these two properties is legitimate.

The Silver Queen property was sold to the Silver Queen Mining Company for $810,000 cash. This meant that this amount of capital had to be expended to acquire the property before any ore could be taken out.

In the case of the Cobalt Townsite property, instead of selling it for a large cash payment, which could easily have been obtained, the T. & N. O. Ry. Commission leased the property to the Cobalt Townsite Mining Company on a long time lease (999 years) exacting a payment of $50,000 cash bonus and a royalty on all o extracted.

In the former case the purchaser had to pay the whole $810,000 cash before there was any chance of a return, while in the latter case only 1/16th of this amount had to be paid to begin with, and the further payments were only made as the ore extracted was sold. These royalties to date have amounted to $279,482.72.

The Railway Commission expects to receive further royalties from this property in the future, but the operating company only pays these on receipts from sale of ores. It does not have to assume the responsibility of a large cash payment at the commencement of operations and consequently its capital is left available for development work and the fairness of the arrangement to both parties concerned is obvious.

The royalties received by the T. & N. O. Ry. Commission from its mining leases to the 31st October, 1914, are as follows:

Cobalt Townsite	$279,482.72
City of Cobalt	100,791.13
Right of Way	272,109.17
Nancy Helen	6,126.60
Mining Corporation of Canada	8,405.60
Total	$666,915.22

A number of other mines at Cobalt pay royalty directly to the Government on certain special arrangements, but these have nothing to do with the T. & N. O. Ry. Commission. Thus, when the Crown Reserve mine was sold by the Government, a clause was attached to the deed of sale whereby the Crown Reserve Company paid a certain amount of cash for the property and in addition pays a royalty of 10 per cent. on all ores shipped, the valuation being the gross value at the collar of the shaft. A similar clause was attached to all sales of lots in the Gillies Limit.

The mines paying royalty directly to the Ontario Government are shown in the following statement:

O'Brien, $700,966.07; Crown Reserve, $771,883.44; Hudson Bay, $326,806.35; Chambers Ferland, $26,-256.60; Hargraves, $1,200.00; Waldman, $777.48; Wyandoh, $1,421.72; Provincial, $6,735.14; total, $1,836,-049.84.

The above royalties are paid on the following bases:

O'Brien Mine.—Fifteen per cent. of the net profits as ascertained on the basis of the Mining Tax Act (R.S.O. 1914, ch. 26, sec. 5). The royalty at first was at the rate of 25 per cent. of the value of the ore at the pit's mouth (less surface costs) but was reduced in 1913.

Crown Reserve Mining Co.—Ten per cent. of the value of the ore at the pit's mouth.

Hudson Bay Mines.—Ten per cent. of the net profits as ascertained on the basis of the Mining Tax Act. The rate charged at first was 15 per cent. on the net smelter returns, but was reduced in 1913.

Chambers Ferland Mining Co.—At first 25 per cent. of the value of the ore at the pit's mouth, as in the case of O'Brien Mine. Afterwards reduced to 25 per cent. of the net profits on the basis of the Mining Tax Act; and in 1912 the royalty was abolished, reserving to the Crown the right, in case of rich ore being found in quantity, to impose the royalty up to the extent of 25 per cent. on the net profits as above.

Hargraves Silver Mine.—Same as Chambers Ferland.

Waldman Silver Cobalt Mining Co.—Ten per cent. of the value of the ore at the pit's mouth.

Wyandoh Mining Co.—Ten per cent. of the value of the ore at the pit's mouth.

Cobalt Provincial Mines.—Ten per cent. of the value of the ore at the pit's mouth.

The Peterson Lake Mining Company has divided its property up into 10 acre lots and has leased a number of these lots to independent mining companies on a royalty basis. Thus the Seneca Superior and the Gould are working leases from the Peterson Lake Company paying the owning company 25 per cent. on all ore shipped, calculated on the gross smelter returns. In these cases the royalty is paid to the Peterson Lake Company and none is paid to the Government. Only Bonanza veins can pay on such a basis.

The Ontario Government collects a revenue from mining companies throughout the Province through the operation of the Mining Tax Act. This is a tax, however, and not a royalty, and is calculated on the basis of 3 per cent. on all profits above $10,000 annually.

COAL GAS RESIDUALS.

Coal gas residuals form the bases of many industries. Owing to the great development of by-product coke ovens and gas plants in Germany and the application of modern chemistry to the utilization of their by-products, these industries have largely been controlled by that country. In the readjustment of industrial and trade conditions after the war, it is desirable that as many of these industries as possible be established in Canada and in other parts of the British Empire.

There are two large by-product coke ovens in Canada which produce 67 per cent. of our coke output. These plants are situated at Sault Ste. Marie, Ont., and at Sydney, N.S. Since the outbreak of war, the latter plant has been installing a benzol recovery plant, but, in western Canada, there are numerous beehive coke ovens which do not save any by-products whatsoever. Again, while large quantities of tar are recovered from local gas plants, no industries have been established for the refining, separation and use of the products obtainable from it.

Not only is the saving of the by-products from the coking or carbonization of coal a measure of conservation, but the sale of these residuals is the means of reducing the cost of production in a degree corresponding to the efficiency of the recovery methods adopted and the market value of the products.

This subject is of special interest at this time on account of the effect of the war on the industries dependent on aniline dyes and because the English lyddite and French melinite explosives are made from carbolic acid, a coal tar derivative. A new explosive, trinitrotoluene, is attracting even more attention. It is made from toluene, which is found in the benzol obtained by distillation from tar or in ordinary coal or coke-oven gas.—W. J. D.

THE THEORY OF TUBE-MILLING*

By H. A. White.

As experience has greatly increased our knowledge of the most economical methods of using the tube-mill, it has, at the same time, opened up fresh problems which still await both theoretical and practical solution.

The whole subject may conveniently be considered under the two heads of design and operation. These may be further sub-divided as follows:

Design.—(a) Shape; (b) Dimensions; (c) Linings; (d) Discharge; (e) Feed; (f) Prime mover; (g) Measuring apparatus.

Operation.—(a) Speed of revolution; (b) Load of pebbles; (c) Working level of load; (d) Size of pebbles; (e) Coarseness of feed; (f) Amount of feed; (g) Moisture in feed; (h) Fluctuations in power and speed.

Shape.—From the fact that the operation of a tube-mill depends almost entirely upon centrifugal force arises the theoretical deduction that a long cylinder is the most suitable shape. The length of this cylinder will be determined (if trunnion bearings are used) by strength of material which it is economical to use for its walls, and generally by the amount of feed which it is possible to pass through the tube. The maximum length must obviously not exceed that at which the discharged product is as fine as the final pulp required, and in order that capacity may be fully utilized it is probably best that the pulp discharged should not contain much more than half its weight reduced to the desired fineness. Thus if the final product desired is of —90 material, the tube discharge should not have much more than 45 per cent. of this grade. This ensures a full supply of material to be crushed up to the very end of the mill, though the feed end will be working under the more favorable conditions. The practical limit will favor length (giving larger units), while the merely theoretical aspect would be in the other direction, which tends to remove from the circuit all material fine enough as soon as it is produced. The short tubes temporarily in favor in some parts of the world principally owe their adoption to some other feature of their design, whose effect is not fully appreciated, or to the fact that the tonnage of sand fed is too small for the most efficient work in longer tubes.

The only other shape suggested is a combination of the cylinder with a double cone, and this design is apparently based upon a misapprehension of what takes place in the tube of ordinary shape. This mill aims to provide special arrangements for graduating the power to the work required, but having a varying diameter must be driven at a speed which, however carefully chosen, must be incorrect for a great portion of the load. The varying crushing power, in a direction parallel with the axis, so expensively attained in the Hardinge Mill, is inevitably present in the ordinary mill, in a direction at right angles to the axis, and the well known tendency of the smaller pebbles to travel toward the discharge end of the standard tube mill, gives the advantage of reducing the power consumed at the point where the feed has naturally become finer. It is obvious that the unit of capacity is more cheaply obtained in a cylinder than in a double cone, and no defence of any sort has been put up for the cone at the inlet end.

It might be suggested that a slightly tapered cylinder (say 2 in. wider at inlet than outlet) would be useful, as the lining, if 2 in. thicker at inlet than discharge, as is common with silex liners, would have a cylindrical surface when new, and while giving a uniform "life" along the tube, would improve the tendency to keep the larger pebbles near the feed end and provide a longer average drop at this point where the feed is coarsest.

This construction would not interfere with giving correct speed more than the wear of liners does at present, but it is doubtful if the increased capital required could not be better utilized in a different type of liner, especially as the extra diameter at inlet would have an unfavorable effect upon the adjustment of the "working level" subsequently referred to.

Dimensions.—Having concluded that the shape most suitable is a long cylinder, the relative and absolute dimensions of length and diameter require further consideration.

The diameter of a tube mill will depend upon the size of the largest pieces in the feed and the largest pebbles which can conveniently be used. The weight of the pebble and the diameter of the tube are to some considerable extent mutually compensating factors whose product will determine the largest pieces permissible in the feed.

The longest drop any pebble in a tube will get will be in the layer corresponding with an "angle of departure" of 45 deg., if the speed of revolution is sufficient to give any layer that angle; if not, the outer layer will have the longest drop. The drop cannot therefore exceed 0.8 x diameter of "circle of reference." (The "circle of reference" is the locus of centres of pebbles touching the lining of the tube, and the "angle of departure" is the angular distance from horizontal diameter of tube at which a pebble begins its curve of flight.)

The ft. lb. of energy required to smash any piece of average ore will vary as the square of its diameter, and may be from 2 to 6 ft. lb. for a 1 in. diameter piece, in accordance with shape, etc.

Assuming a maximum of 6 ft. lb. for 1 in. feed, pebbles approximately spherical with Sp. Gr. 2.75, and tube linings of 4 in. thickness, if the largest pieces of ore to be fed were of 1 in. diameter the following would be diameter of tubes required:

For a 4-in. pebble a tube diameter of 39 in.; for a 3-in. pebble a tube diameter of 76 in.; for a 2-in. pebble a tube diameter of 226 in. In a similar manner it may be calculated that a standard tube of 5 ft. 6 in. x 22 ft. will not take a feed coarser than ½ in. unless a sufficient proportion of pebbles larger than 2 in. are present.

Similarly, if it were required to design a tube to take ore direct from the rock-breakers with a maximum size of 3 in., the diameters corresponding with various pebble sizes, putting the blow required at 36 ft. lb., and allowing for a lining 4 in. thick would be:

For 6 in. pebbles a tube of 5 ft. 2 in. dia.; for 5-in. pebbles a tube of 8 ft. dia.; for 4-in. pebbles a tube of 14 ft. 6 in. dia.

As, however, the blow is mitigated by resistance of semi-fluid pulp so that in practice it is found that feed larger than ½ in. is somewhat unsatisfactory with the 5 ft. 6 in. tube, though the pebbles present therein will average about 0.65 lb. (2¼ in.) with lumps of rock fed in at an average of about 2 lb., it is probable that a suitable tube for taking ore direct from the rock-

*Extracts from a paper presented at a meeting of the Chemical, Metallurgical and Mining Society of South Africa.

breakers would have an inside diameter not less than 8 ft., and the coarse ore fed in to form pebbles would be lumps from 6 in. to 8 in. cubes. In such a case it would probably prove advantageous to use a second row of ordinary tubes for the final reduction.

The capital cost for the cheapest design will depend upon the relative cost per square foot of barrel and ends. If a square foot of end costs "n" times a square foot of barrel, then the length must be "n" times the breadth. In designing a tube all the costs which are affected by the diameter must be tabulated for the various sizes and a similar set of calculations made for the various lengths and upon the above principles a determination can then be made of the best relative dimensions. I am informed that the ratio so determined will be about 4 to 1, which implies that the ends, including driving pinion, trunnions, etc., cost four times as much as the cylinder per square foot. It has, of course, been assumed that the internal capacity is a reasonable measure of the work a tube mill can be made to perform, which is in practice found to be roughly accurate.

Other considerations are of at least equal importance with considerations of prime cost, and the principal one appears to be connected with the amount of feed it is practicable to pass through the tube so that the full length may be utilized. Four hundred tons per day is quite common on the Witwatersrand, and this seems to be sufficient for the ratio of 4 to 1 with a 5 ft. 6 in. diameter tube; but it would be difficult to set a limit for the possible amount if the feed and discharge inlets are suitably arranged.

Before proceeding with the other divisions of our subject, a reference is necessary to the experiments recently carried out by the Mines Trials Committee, which has been kind enough to give permission to make use of the results obtained.

This series of experiments was carried out in the ore-dressing laboratory of the South African School of Mines and Technology by Professor G. H. Stanley, assisted by Mr. Morris Green.

Experiments were undertaken to observe and measure—

(a) The effect of varying speeds of revolution
(b) The effect of varying loads of pebbles.
(c) The effect of different "working levels" and the ascertaining of the most suitable discharge screens.
(d) The effect of varying sizes of pebbles and feed coarseness.
(e) The effect of varying kinds of tube lining.
(f) Testing the practicability of using a continuous automatically replacing lining of the pebbles themselves.

During the conduct of the trials it was further decided to

(g) Measure the fluctuation in speed and power consumption during a revolution of the tube.

The tube was a cylinder of ½ in. iron with a diameter of 77 in. inside and a length of 18 in. mounted on a heavy cast-iron spider and driven by gearing. The back was of 1 in. ribbed cast iron mounted on a shaft 7 in. diameter. The front was closed in by 1 in. iron screening, prevented from bulging out by two strong iron supporting plates. A man-hole was used for introducing or removing pebbles. The spur-wheel on the shaft was cut steel gearing with 150 teeth, pinion 20 teeth, counter shaft belt pulleys 30 in. and 20 in. diameter, motor pulley 8 in.

A 25 H.P. shunt wound motor was supplied, and the speed varied by using suitable resistances, and this gave no trouble. The calculations on power consumed do not take into account any variation in efficiency caused by changing speed, as the engineers did not consider this of importance.

Imported Danish pebbles from 2 in. to 4 in. diameter were used, and a very fine spray of water had to be directed upon them to keep down the dust. All the observations are upon the tube loaded with pebbles only.

The voltmeter and ammeter employed were carefully calibrated from time to time.

The tachometer supplied was of little use as its readings were not sufficiently "dead-beat." A stopwatch was therefore used in counting number of revolutions. Various subsidiary apparatus was used to determine levels and "angles of departure" of pebbles, etc. As the light was insufficient, no cinematograph record could be taken, as intended, but numerous diagrams were drawn from eye observations to illustrate the appearance of the moving pebbles under the various conditions. Several oscillograph records of the current consumed, and tracings of an electrically vibrated tuning fork upon smoked paper wrapped round the shaft were also taken, the latter being used to determine the variation of speed during a complete revolution of the tube.

All the observations recorded were made with the tube mill containing pebbles only, thus securing simplicity and definiteness. Any practical application of the deductions when sand and water are present requires due allowance for these factors.

Linings.—The liner used for most of the experiments was of plain concrete, and this wore away very rapidly, especially at first while it was fairly new, and the wear was not very regular. A concrete surface does not appear to have much "grip" on the pebbles, and according to the calculations made on observed figures it allowed more "slip" than even the unlined tube.

A steel bar liner, arranged alternately flat and upright in the usual manner, was found to take up pebbles well till the actual working surface consisted of pebbles. The wear in this liner was not measureable during the experiments made with it, and the working surface appeared to take up the pebbles well, giving a minimum amount of "slip."

No other kind of liner was available for experiments, but the experimental tube mill remains available for trials in this direction, if at any time such appear to be desirable.

An objection to the bar liner of the Osborne or similar types is the greater amount of amalgam held up thereby as compared with the silex liner. This may be to some extent minimized by using cement as a backing to fill up interstitial spaces, but even with great care the retention of amalgam is capricious, and may vary on the same mine from 500 to 2,500 oz. It will, however, do almost as efficient work at the first hour of starting as at the end of its life, and this compares favorably with the indifferent work done when a new thick silex liner is started up.

Upon driving a tube beyond a certain critical speed, one or more layers of pebbles may be made to adhere to the circumference, and thus form an automatic lining, which would replace itself as it wore out.

TABLE I.

Diameters and R.P.M. to Make Layers of Pebbles Continuous.

The diameters given refer to the "circle of reference" and show measurement inside tube lining less diameter of pebbles used. A layer of pebbles is said to be "continuous" when it adheres to the circumfer-

ence of the tube or lining during a complete revolution.

Diameter	1st layer continuous		All Pebbles Continuous		
	R.P.M. Calculated	R.P.M. Observed	R.P.M. Calculated	R.P.M. Observed	Load
in.					in.
53	36.4	36.0	40.8	46.0	
54	36.1	——	40.5	——	+ 5
55	35.7	——	40.1	——	——
56	35.4	34.7	39.8	46.2	——
57	35.1	35.5	39.5	47.8	+ 2
58	34.8	35.0	39.1	48.5	+ 4
59	34.5	34.5	38.8	47.2	+ 10
60	34.2	(39.0)	38.5	47.2	+ 12
61	33.9	——	38.1	——	— 7
62	33.6	(38.0)	37.8	49.0	——
63	33.4	——	37.5	——	0
64	33.1	33.2	37.2	46.0	——
65	32.8	——	36.9	——	+ 6
66	32.6	33.5	36.7	51.2	——
67	32.3	——	36.4	——	+ 12
68	32.1	33.7	36.1	51.2	——
69	31.9	——	35.9	——	+ 17
70	31.6	——	35.6	——	——
71	31.4	——	35.3	——	——
72	41.2	——	35.1	——	——
					——

It will be observed that slightly more than the theoretical speeds are required to make the first layer continuous, and that though an increase of 3.9 to 4.4 R.P.M. is theoretically sufficient to take up all the pebbles to the circumference, in practice an increase of 10 or 12 R.P.M. is required (owing to excessive slip in inner layers); the greater speed is naturally required with very heavy loading as the inner circle formed by the last pebbles taken up is proportionately smaller. To take up two or more layers on the circumference, the R.P.M. would require an extra revolution per minute for each layer, more or less, in accordance with size of pebbles and diameter of layer formed. It is evident, therefore, that if the speed were set for two layers of pebbles to form an automatic lining, a variation in speed of 3 per cent. either way would result in increasing the layers to three or reducing to one. There is consequently no great difficulty in this direction, but the fact that an increase in speed is in these cases accompanied by a decrease in power consumption requires the provision of a constant speed prime mover.

In all cases where a continuous layer of pebbles is maintained on the liner, it was found that the smaller pebbles reached the circumference; experiments with a very small model tube mill with sand present showed that if the speed were gradually increased only sand was found on the circumference, but a rapid increase of speed up to the required point enabled the much larger beads used to form the automatic layer. It may be anticipated that in practice as the layers on the circumference become reduced in size by wear, the tendency will be for their place to be taken by sand, and especially by pyrite or amalgam, because the smaller particle can be held there by the centrifugal force where a larger particle would fall, as its centre would fall outside the limiting circle fixed by the speed of revolution.

Discharge.—While the inlet opening to the tube need only be large enough to pass the largest pebbles to be fed in, with an allowance for the wearing lining, the diameter of discharge aperture may either be large enough to bring down the level of the semifluid pulp to the required point, or the discharge screen may be provided with a lifting scoop delivering to a discharge outlet of smaller diameter.

This discharge scoop works in a chamber cut off from the end of the tube by a false end plate, provided with a screen having the diameter required; and iron balls or a few stem ends might be placed therein to smash up the small pebbles passing this screen, after the manner of the ingenious arrangement by Mr. Thurlow at the New Modderfontein.

Feed.—The Schmitt Feeder is very satisfactory and flexible, and where this is used there is no reason why the inlet to tube should not be of sufficient diameter as to obviate the possibility of jamming of the pebbles fed and to allow larger rock to be used for this purpose where desired.

Prime Mover.—The peculiarity of the tube mill that an increase of speed may have the effect of reducing the power consumed renders it necessary that the prime mover should be of a constant speed type to avoid the possibility of a dangerous runaway. This should be more especially necessary if the automatic lining of pebbles were used, as in this case the normal speed is much nearer the danger limit.

Measuring Apparatus.—The present usual method of controlling the pebble feed to tube mills by means of an ordinary ammeter in a three-phase circuit has several disadvantages. In the first place it does not discriminate between loads above and below the maximum power consumption, and of course the reading is directly influenced by the variations in the voltage of the power supply which at times are very considerable. Where measurement of power consumed must be relied upon, the most advantageous instrument would be a graphic recording watt-meter and a daily chart from this would be a useful check upon the regularity of maintenance of the required pebble load. If the same level of load is maintained in a silex liner it is obvious that the power consumed will vary with the wear of the liner, but experience will enable this variation to be properly allowed for and the chart may be marked as a guide.

It will be obvious that in comparative trials with various adjustments an integrating watt-meter, duly calibrated, is the only reliable instrument where motors are used and figures based upon comparative ampere readings are quite useless.

It is to be regretted that no reliable method of directly measuring the pebble load, while the tube is running has yet been devised, though some operators consider that the load may be roughly judged by pushing a thin iron rod through the centre hole of the discharge screen and thus judging the depth of the fallen pebbles.

In ordinary tube mill installations driven by three-phase motors, one integrating watt-meter would be sufficient for all the tube motors to enable power charges to be properly allocated, one ammeter and one voltmeter would likewise be sufficient for the whole circuit, while each motor switchboard should be provided with a recording watt-meter, and an ordinary indicating watt-meter should be placed in a secure position, clearly visible from the pebble feeding point.

The effects of varying speeds of revolution.—In all the experiments carried out under this head, the power consumed when the tube was running empty at the various speeds was first determined. The net power after deducting these results from the final reading refers therefore to the power actually consumed in lifting pebbles, plus internal friction inside the tube. It may be assumed that the power actually consumed in lifting pebbles will be a fair measure of the crushing capacity of the tube, and that at anything like reasonable speeds and loads the amount of fine material produced per H.P. will not vary to any great

extent, in the same way that heavy stamps have a high crushing power per machine unit, but no greater product per H.P. than lighter stamps.

It was very obvious on watching the fall of the pebbles, that greater loads required higher speeds to develop full power consumption, the effect of the greater speed being to provide adequate paths of free fall for the greater load of pebbles. If the speed was too low or the tube too crowded at the speed used, the inner layers of pebbles had no space for free fall and were merely carried round and round with slight relative movement, which in most cases would mean wasted power. The low power shown with excessive loads is due to the further effect of the pebbles, after filling up this inner cavity, heaping up at the bottom of the tube and thus lessening the fall of the other pebbles present until the speed was great enough to carry up the excess pebbles on to the rim. A free fall was thus again secured, but of course the effective tube diameter was reduced by the pebbles adhering to the lining.

It was observed in practicable cases that the angle of departure corresponding with the inner layer cannot be much less than 30 deg. if free fall is secured, and this is the limit of loading at any speed beyond which there is a loss of efficiency. If more pebbles are added there is no free space between the rising layer and the falling pebbles.

It has not been found possible to devise any means of gauging this free space in a working tube, as it always contains a few jumping pebbles, though observations with a small model show it to be free from sand. At present there is no means of determining from power readings upon which side of the maximum loading effect a given tube is working.

An interesting visual observation was that at very low speeds the smaller pebbles gathered towards the centre of the tube, at practicable speeds no segregation was noticeable, and at speeds beyond the critical the smaller pebbles worked out to the periphery. This is also observable with sand and glass beads in miniature model.

The noticeable points in the following table are the increased speed (necessary for maximum power) required for increased load: the slow rise in power up to the maximum and the quicker fall thereafter; especially from the point at which pebbles are picked up on the lining.

Further observations on the effect of speed variation will be found under the next heading, where they can be more suitably discussed.

Table II.—Variation in Power with Load Constant at Various Speeds.

I.—Diameter inside concrete lining beginning 58 in., end 59 in.

Pebble load 2 in. above centre level—weight 1,400 lb.

II.—Diameter inside concrete lining beginning 61 in., end 62 in.

Pebble load 12½ in. above centre level—weight 2,520 lb.

III.—Diameter inside concrete lining beginning 62 in., end 62.6 in.

Pebble load 7 in. below centre level—weight 1,300 lb.

I.		II.		III.	
R.P.M.	Net H.P.	R.P.M.	Net H.P.	R.P.M.	Net H.P.
24·0	3·79	24·6	2·57	23·2	4·51
				24·6	4·67
25·0	4·23	25·7	2·67		
26·0	4·24			26·0	4·78
26·5	4·40	26·5	2·83		
27·0	4·46	27·4	3·10	27·4	4·93
27·7	4·56				
28·2	4·51	28·0	3·32	28·0	5·04
29·0	4·46	29·2	3·64	29·0	5·04
29·5	4·66				
30·0	4·66	30·0	3·80		
30·5	4·66				
31·2	4·98	31·2	3·97	31·0	4·55
32·0	4·98	32·2	3.59		
32·4	4·64				
33·7	4·41	33·0	3·32		
34·7	4·22	34·5	3·03	35·0	2·71
		35·5	2.63		
37·7	2·51	37·0	2·44	37·0	2·67
		38·2	2·23		
39·4	1·91	39·2	1·93	39·0	2·03
				39·7	0·58
40·5	1·56	41·0	1·81		
42·6	1·23	43·7	1·37	42·5	0·29
46·2	0·58	46·2	0·67	47·2	0·19
		47·2	0·39	49·2	0·09

The above are selected from the very numerous experiments in order to show the various effects at different speeds with normal, under, and overloading of tube.

BETHLEHEM STEEL.

The New York Times declares there is not the least danger of German interests getting control of Bethlehem Steel. Majority control of stock is not on market. Charles M. Schwab still owns a majority of stock and has no intention of selling it. It is declared that Mr. Schwab could get $100,000,000 for his stock if he so elected. It is stated that English interests learned last fall that Mr. Schwab had been offered fabulous figures for his majority ownership, but was promptly guaranteed orders by British war office big enough to keep Bethlehem going for 18 months. Mr. Schwab says: "My interest in the Bethlehem Co. is not for sale. I have contracts that I cannot break."

GRANBY.

In connection with recently published reports to the effect that now that the Granby Consolidated Company has arranged for paying off its floating debt by the sale of six per cent. convertible bonds the payment of dividends will soon be resumed, the statement is made that the directors cannot yet be influenced to declare a dividend; on the contrary, action in this direction will not be taken until they shall think fit. The fact that some of the mines of the company were closed for several months following the declaration of war last August seems to have been forgotten by many. There were overhead charges which had to be met from surplus, so the company is now renewing the strength of its financial position.

CORUNDUM MINING IN ONTARIO*

By Alfred Ernest Barlow.

[Dr. Barlow was lost on the Empress of Ireland. His Memoir on Corundum has just been published.]

The presence of corundum in the northern part of the county of Hastings, Ontario, was really made known as the result of a visit made in October, 1896, by Mr. W. F. Ferrier, then lithologist to the Geological Survey of Canada. In the Summary Report for the year 1896 Mr. Ferrier relates the history of the discovery and the circumstances which occasioned his visit to that region. He writes: "One of the most interesting occurrences upon which I have to report is the recent discovery of corundum in Hastings county, Ontario. This came about in a somewhat unusual way. In 1893 I came into possession, by purchase, of a number of specimens collected by Mr. John Stewart, formerly of Ottawa, amongst them being a package labeled 'Pyroxene crystals south part of Carlow.' On examining these specimens some time ago I recognized them as corundum, and immediately took steps to ascertain, if possible, the precise locality from which they came. As you are aware I communicated the facts to you and was authorized in October to visit the township of Carlow, endeavor to locate this mineral, and determine the extent of the deposit. I was accompanied by Mr. A. A. Cole, and after considerable difficulty found the mineral on lot 14, con. 14, of the township of Carlow, Hastings county, Ontario."

The growth of the corundum mining industry of Canada which was only made possible by and is a direct outcome of Ferrier's initial discovery, has been both steady and rapid. Starting in April, 1900, about 60 tons of graded grain corundum was produced, although only 3 tons of this were shipped. In the following year 444 tons was produced; in 1903 this production was nearly doubled when 806 tons of corundum was cleaned and graded. The maximum output was in 1906, when 2,914 tons was produced, but only 2,274 tons was sold, valued at $204,973. In the following year there was a very much greater discrepancy between production and sales, due to the industrial depression prevailing in 1907, and of the total output of 2,682 tons credited to this year, 790 tons was left in stock in the warehouse. From 1909 to the present there has been a better balance preserved between production and shipments, so that in 1912 there was the large shipment of 1,960 tons of graded grain corundum valued at $239,091, being the largest amount received since the establishment of the industry. Of this large total in shipments, 1,928 tons valued at $205,819 was exported, leaving only 32 tons to supply the home market. The total shipments of corundum made since the beginning of the industry until the end of 1913 have amounted in value to nearly $2,000,000.

The corundum bearing areas are situated close to the edge of the great Canadian Shield of the pre-Cambrian rocks, about midway between Ottawa and Toronto. They are in the midst of an old and partially settled district with numerous wagon roads, some of which are good while others can only be considered as passable. Craigmont, the centre of the corundum mining industry, is most easily reached from Barrys Bay, a station on the Ottawa and Parry Sound branch of the Grand Trunk Railway, 109 miles west of Ottawa. Barrys Bay is nearly 12 miles north of Combermere, a small village on the Madawaska river, about 7 miles north of Craigmont. A small steamer provides daily communication for passengers and mail between Barrys Bay and Combermere, and at certain intervals reaches Francois point on the York river, the deep water landing place about 2½ miles from Craigmont.

The Irondale, Bancroft and Ottawa Railway runs almost parallel with and usually in the vicinity of the southwestern extension of the main belt of the corundiferous syenites from Kinmount Junction (where it connects with the Lindsay-Haliburton branch of the Grand Trunk Railway) to Bancroft, a distance of a little more than 54 miles. At Bancroft connection is made with Central Ontario Railway for Trenton, on the main line of the Canadian Northern and Grand Trunk Railways, the intervening distance between these stations being about 86 miles. Trenton is 110.5 miles east of Toronto on the Canadian Northern Railway and 101.19 miles by way of the Grand Trunk Railway. The Central Ontario Railway crosses the Toronto-Montreal line of the Canadian Pacific Railway at Central Ontario Junction, 224.4 miles west of Montreal or 114 miles east of Toronto.

The Kingston and Pembroke Railway affords access to the most southerly of the three belts of corundum bearing rocks, Olden station, between Sharbot Lake and Kingston, being located on this belt.

Investigation of the corundum deposits.—The Director of the Bureau of Mines of Ontario being convinced of the great importance of the discovery of corundum, and the probability of the early establishment in this region of an extensive mining industry, deputed Mr. Willet G. Miller, then professor of geology at the School of Mining, Kingston, Ontario (now Provincial Geologist of Ontario), to carry out the necessary investigations. Much interest had been evinced by the discovery of this mineral by manufacturers of emery wheels and others so that it seemed advisable that a careful examination should be made at once of the Carlow deposit in order to obtain more information, especially from an economic point of view. Moreover it was considered that a determination of the character of the deposit would materially assist in the intended search for other occurrences of the mineral in the district. Professor Miller's instructions, therefore, called for an examination of the corundum bearing rocks, and to search for other deposits of the mineral in the district as well as to make careful notes on deposits of other minerals of economic importance which might be met with in the field. In this work Professor Miller had the able and zealous assistance of Messrs. R. T. Hodgson and W. C. Rogers, then students at the Kingston School of Mining. Early in July in company with Mr. N. T. Armstrong, of New Carlow, Professor Miller spent a few days in the study of the original locality where corundum had been discovered, as also two other deposits of the mineral in this vicinity. Later in the season, from August 2 until October 15, Professor Miller, having closely studied the mode of occurrence of the corundum, spent most of the time in prospecting for the mineral in the northern part of the county of Hastings, and the southern part of the adjoining county of Renfrew. As a result outcrops of corundiferous rocks were found in seven different townships, covering a distance of about 30 miles.

*Extracts from Memoir 57 Geological Survey, Ottawa: Corundum, its occurrence, distribution, exploitation and uses, by Alfred Ernest Barlow.

Development of the corundum deposits.—The great extent and comparative richness of the Ontario corundum deposits prompted the Government of that province to take such action as seemed best calculated to develop the deposits and also to establish a home industry. Regulations were accordingly drafted under which the mineral rights in lands lying within the known areas of corundum-bearing rocks were withdrawn from sale, so that their acquisition for mining purposes could only be obtained under the leasehold system. An order-in-Council was adopted on July 4, 1898, embodying a series of provisions having such a purpose in view, it being stated that the Commissioner of Crown Lands may receive tenders for mining lands and mining rights in the explored belt to the 15th day of September, 1898.

Only one substantial tender was received under the terms of the proposed regulations, but an agreement upon all details was not reached until September 15, 1899. The contract was entered into with the Commissioner of Crown Lands by Messrs. Joseph H. Shenstone and B. A. C. Craig, of Toronto, on behalf of the Canada Corundum Company. A partial agreement, however, was made on September 15, 1898, with these same gentlemen, together with Mr. Lloyd Harris, of Brantford, that they should explore the corundum belt and select corundum-bearing lands from it, not to exceed 2,000 acres. Mr. Thomas Hodgson, who had been Professor Miller's assistant in the two previous years, and Mr. M. B. Baker, of Kingston, were engaged to do the necessary prospecting for the location of workable deposits of corundum. By September, 1899, a total area of 1,400 acres had been chosen and these lands were leased on September 15 to the Canada Corundum Company, who were organized to carry on mining and milling operations.

The Canada Corundum Company was, therefore, the first in the field, and in addition to the mining areas leased from the Government, purchased other lands from private owners. These included certain lots having deposits of corundum situated in Raglan, Radcliffe, Brudenell, Carlow, Monteagle and Dungannon townships. Briefly stated, the agreement between the Ontario Government and the Canada Corundum Company, granted to the latter the exclusive right to make the first selection of corudum deposits throughout the Ontario corundum-bearing area, on lands whose mineral rights were still vested in the Crown. The company, as their part of the covenant, agreed to the expenditure of $100,000 on certain specified conditions in the development of these mining lands and the establishment of a corundum industry. The agreement also entailed an obligation on the company's part to conduct certain experiments affecting the use of corundum especially as an ore of aluminum.

Active mining development work was inaugurated in April, 1900, under the supervision of Mr. Thomas Hodgson. The village and post-office were called "Craigmont" in appreciation of the services of Mr. B. A. C. Craig, the first vice-president and general manager of the company, to whose optimism and insistence the world is indebted for the establishment of its greatest natural corundum industry. An old sawmill, with a small water power, on a creek flowing near the base of Robillard mountain, on which the corundum deposits are situated, was almost entirely remodeled, and concentrating machinery, with a crushing capacity of about 20 tons of corundum bearing rock daily, was installed. This mill is about 7 miles from the village of Combermere on the Madawaska river. At first water power alone was used, but in a very short time this was supplemented by a 25 horsepower steam engine. Mining or quarrying operations (for the corundum rock was obtained by means of a series of large open-cuts or excavations), were undertaken on lots 3 and 4, concession 18, of Raglan, and later were extended into the same lots with addition of lot 2 in concession 19, of the same township. The equipment of the mill, which is located close to the line between lots 1 and 2, concession 18, was mainly designed for experimental purposes, following Prof. De Kalb's experimentation at the Kingston School of Mining, but on a much larger scale. It anticipated the construction of a much larger mill when the various problems attending the concentration of the corundum would be more thoroughly understood. Before the end of the year (1900) about 60 tons of cleaned, graded corundum were produced, but of this amount only 3 tons were sold.

Other companies organized.—In 1901, the Imperial Corundum Company, as also the Crown Corundum and Mica Company, both of Toronto, Ontario, were organized, and the same year did a considerable amount of development work, the former on lot 14 and part of lot 15, concession 8, and the latter on lot 14, concession 9, of the township of Methuen, in Peterborough county.

It was the irony of fate that despite the somewhat unusual imposed conditions affecting the lease by the Ontario Government of lands in the belt of corundum bearing rocks, all mining activity, even that contemplated, was on lots which were deeded to the original settlers, inclusive of the mineral rights, many years before.

In the spring of 1901, Mr. John Donnelly, of Kingston, convinced that other deposits or corundum might be found which had not been selected by the Canada Corundum Company, who had been accorded special permission by the Ontario Government to make the first selection of corundum-bearing lands, engaged Messrs. M. B. Baker and A. Longwell to prospect for occurrences of corundum, which gave promise of development as mines. These gentlemen, after a search of about six weeks, selected the corundum deposits situated on lots 27 and 28, concession 19, of Raglan township, in the county of Renfrew. Besides the advantageous situation of these occurrences on the side of a big hill, the location is within a short distance (2.5 miles) of Palmer rapids on the Madawaska river, a water power which with a head of 17 feet has a minimum capacity of 980 horse-power. A company known as the "Corundum Refiners, Limited," was organized under the management of Mr. P. Kirkegaard, formerly of the Deloro Gold Mines, to develop this property. Plans were also made for the erection of a large mill at Palmer rapids, but up to the present time, with the exception of some stripping and other preliminary mining development work, little or nothing has been done.

Ontario Corundum Company.—In July, 1902, the Ontario Corundum Company, with offices at Ottawa and Boston, commenced corundum mining operations at the locality where corundum was originally discovered by Ferrier (lot 14, concession 14, of Carlow township) now known as Burgess Mines. A Blake crusher, 7 x 10 in., was installed to crush the corundum-bearing rock, but it was afterwards found better to cob the ore into large lumps, this hand sorting resulted in a pro-

duct which would average about 15 per cent. of corundum. This practice was continued until the latter part of 1903, the high grade cobbed product being shipped to the United States for further concentration.

At the end of 1902, the new mill for this company was completed, and high grade, grain corundum was then produced and shipped. The practice adopted was that in use in the corundum mills of North Carolina and Georgia, the crushed rock going to mullers to separate the corundum from the micaceous and decomposition products associated with it. The fines were thus washed away and only the coarser material, after being dried and sized, was concentrated.

The large mill for the Canada Corundum Company was started in January, 1903, and about a year was required to build and equip it. It had a capacity of about 200 tons per day of corundum rock, with a production of between 10 and 12 tons of graded grain corundum daily.

In this same year a detailed contour survey of the southern side of Robillard mountain was made by Mr. John A. Baker, the whole of this slope being denuded of trees. This enabled an accurate mapping of the various outcrops of corundum-bearing rocks, noting any peculiarities of composition, and especially of the presence and relative abundance of corundum. This mining geological work was done by Mr. Alex. Longwell.

In the spring of 1904 the mill of the Ontario Corundum Company was destroyed by fire, but before the end of the year another and larger mill was designed and constructed in which the principle of concentration by dry methods was adopted. The Armstrong property (lot 14, concession 14, Carlow) was operated as a quarry for corundum by the Ontario Corundum Company until June 1, 1905.

The Imperial Corundum Wheel Company, with head office at Buffalo, N.Y., did some preliminary mining development work on lot 13, concession 1, of Monteagle township. The material secured was sorted by hand and the high grade product thus obtained was shipped to Springfield, where it was further concentrated.

The Ashland Emery and Corundum Company were the successors of the Ontario Corundum Company, beginning operations on January 1, 1906. During this year they prospected several locations for corundum in the vicinity of their mill at Burgess Mines, especially at John Armstrong's hill, on lot 10, concession 15, of Carlow. In view of this and the difficulties attending transport, shipments were small and irregular.

During 1906 the Canada Corundum Company, under the managership of Mr. H. E. T. Haultain, did considerable prospecting and some stripping on certain lots in the first and second concessions of the township of Monteagle on the southeast side of the York river. Most of the production for 1906, which amounted to 2,914 tons of grain corundum, valued at $262,448, must be credited to the Canada Corundum Company. Both the Canada Corundum Company and the Ashland Emery and Corundum Company were operating in 1907, the former company producing a considerable tonnage, while at the same time endeavoring to sell the large amount which they had in stock in their warehouses. The latter company in this interval was prospecting besides making some mill runs. A few shipments were made, but mining operations were conducted on a small scale. About the beginning of the year 1908, the Canada Corundum Company ceased operations owing to over-production and the small demand of the market for graded grain corundum. Throughout the year the company was busy trying to sell this great surplus product.

Manufacturers Corundum Company.—In 1909 the Manufacturers Corundum Company acquired the mines and mills of the Canada Corundum Company, and also in the following year the concentrating plant and the properties of the Ashland Emery and Corundum Company. Mr. D. A. Brebner, with headquarters at Toronto, is manager, with Mr. E. B. Clark as assistant manager at Craigmont.

In addition to the corundum quarries at Craigmont, a considerable tonnage has been secured from the corundum deposits immediately north of Grady lake, on lots 14 and 15, concession 16, and at present from lot 10, concession 15, of Carlow township (John Armstrong's hill). Until the total destruction by fire in February, 1913, the operations of the Manufacturers Corundum Company and the consequent production have both been maintained on a large scale, but the burning of their mill will bring about a serious curtailment in their activity, as under the most favorable conditions the capacity of this mill at Burgess Mine cannot be made to exceed 3 tons daily of graded cleaned corundum, operated at its maximum capacity. Furthermore there must be an undue loss, resulting from the crowding of the material and the imperfection of the method in use which is a combination of the wet and dry process.

Progress made.—The corundum industry of Canada, as represented by the operations of the companies, an epitome of whose history has just been related, has made very substantial progress in spite of very many disadvantages. Most of these difficulties were in a manner inherent and peculiar to the product sought to be exploited. Perhaps the most serious disability from which the industry at first suffered, related to its concentration and preparation for market, but closely related adverse conditions affected the selling of the refined article when brought to the high standard aimed at and reached. Almost from its inception it had a worthy competitor in carborundum and a little later alundum, and both of these artificial abrasives have in many fields successfully challenged the superiority of the natural substance. In spite, however, of this very serious competition, there is a steady and a very insistent demand for corundum, which may be regarded and with good reason, as preferable to all other abrasives in certain classes of work. In spite of the very substantial assistance from a practical point of view of the Ontario Bureau of Mines, which in the first place not only directed and controlled the prospecting for corundum, and the concentration of corundum-bearing rock, but helped by their expressed faith in the industry, in the final financial arrangements, the industry had a very small beginning, although its subsequent growth was both rapid and steady. As discovered and first described, the mode of occurrence and geological association of corundum in Hastings were believed to be unique, and it soon became evident that the problems attending its concentration were not only in many respects novel, but likely to prove very complex before corundum of the purity desired could be produced.

Transportation, at first sight apparently simple and inexpensive, proved on experience to be unduly costly and for the most part inadequate. The local labor

supply was small and irregular, many of the men employed being unaccustomed and averse to continuous work, and recourse was had to the most trivial domestic demands to secure immunity from steady employment. For many years after the beginning of operations there were frequent changes in the direct management, the mine superintendent alone being allowed to remain until the present time, despite the fact that, either as managers or superintendents some of them had already gained a world-wide experience in concentration methods. The publicity and selling departments also shared in these initial and to some extent unusual difficulties. At first the main objective of those in charge of this department was to supplant emery as an abrasive, ignoring the fact that certain peculiarities in the physical character and composition of emery recommended its use in wheel manufacture, notwithstanding the very manifest superiority of Ontario corundum both as regards purity and abrasive efficiency. Each, although in many respects rivals, as abrasives have certain spheres of usefulness, which may not be invaded by the other. Those in control of the corundum industry neglected altogether to so extend their operations as to engage in the manufacture of the various products requiring the use of corundum, contenting themselves with the less lucrative production of graded grain corundum. However, owing to the unbounded optimism and energy of those in control, especially Mr. B. A. C. Craig, and later Mr. D. A. Brebner, the various difficulties were gradually overcome and the industry firmly established. The various grades of corundum produced are now accepted as standard by the numerous wheelmakers and others engaged in the use of corundum as an abrasive. The degree of purity guaranteed is very closely maintained, while until the total destruction of the big mill at Craigmont, the trade were sure of obtaining a steady and abundant supply of a very uniform product.

Almost coincident with this fire disaster, although more slowly realized, came the conviction that the corundum deposits of Craigmont (Robillard mountain) which were at first thought to be inexhaustible, had reached a stage when it was both difficult and expensive to obtain a sufficient supply of the desirable quality of ore. The decision that such ore is by no means abundant on this hill has been reached by reason of rather extensive drilling and tunnelling operations, combined with the knowledge gained in the operation of the large excavations or quarries. There is, however, a considerable supply of good corundum ore in the deposits north and west of the Burgess Mines in Carlow township. Other deposits of corundum which are regarded as of commercial grade and size, occur in the vicinity of Palmer rapids, in the north-eastern part of Raglan township. These likewise have the advantage of convenient location to existing means of transportation. Deposits of corundum of very distinct promise occur in Brudenell township and in the northwest corner of Faraday township. The mill tests of the material secured from the Monteagle and Dungannon localities in the vicinity of the York river are said to have been disappointing. Transportation will again largely determine the scene of future operations. Competition of artificial abrasive has no doubt lessened the demand and price for natural corundum, but in spite of these there is always a ready demand for the natural product, especially in times of industrial activity. The future of the industry, although uncertain, is by no means without hope.

INTERNATIONAL NICKEL.

The International Nickel Co. has issued its report for the year ended March 31, 1915. The consolidated income account compares as follows:

	1915.	1914.
Earn. con. cos.	$7,049,112	$6,452,758
Other income	181,649	114,029
Total income	$7,230,760	$6,566,787
Exp. tax	517,374	437,812
Net income	$6,713,387	$6,128,975
Int., dep., etc.	1,115,315	1,336,310
Surplus	$5,598,071	$4,792,665
Preferred div.	534,756	534,756
Bal. for com.	*$,063.315	$4,257,909
Common divs.	4,753,938	3,803,150
Surplus	$309,377	$454,759

*Equals to 13.31 per cent. on $38,031,500 common stock, as against 11.19 per cent. on same stock previous year.

The general balance sheet compares as follows:

Assets.

	1915.	1914.
Prop.	$44.016.051	$44,552,025
Adv. Nickel Corp	3,157	1,668
Def. charges	......	39,235
Secr'd loans on call	1,000,000	......
Stocks and bonds	58,210	137,838
Certf. of dep.	950,000	......
Inventories	3,100,381	4,289,021
Accts. rec.	1,416.092	1,615,405
Bills rec.	11,071	10,050
Interest	39,270	......
Adv. for int.	58,529	52,295
Cash	4,542,539	3,243,672
Total	$55,195,300	$53,941.207

Liabilities.

Com. stock.	$38.031,500	$38,031.500
Pref. stock	8,912,600	8,912,600
Misc. Funds	165,501	164.979
Accounts pay.	637,239	642.984
Acc. taxes	89,582	92,757
Common divs.	1,901,575	950,788
Accrd. int.	7,989	5,662
Preferred div.	133,689	133.689
P. and L. surplus	5,315,624	5,006.247
Total	$55,195,300	$53,941.207

In his remarks to stockholders, President Monell says:

"During the fiscal year just closed, the general disarrangement, in both our domestic and foreign business, due to the outbreak of the European war, caused a general curtailment in the demand for the company's products for several months following the outbreak of hostilities.

"In the late fall, when domestic conditions and those affecting foreign shipments and foreign exchange had become adjusted to meet the changed state of affairs brought about by the European war, an increasing demand for the company's products became apparent, with the result that the volume of business for the fiscal year has been somewhat greater than heretofore.

"The plan of extending to the company's employees the opportunity of purchasing stock on a monthly instalment basis, which was inaugurated last year, was continued this year with equally satisfactory results. During the fiscal year the number of stockholders has increased from 3,752 to 4,465."

A NEW MACHINE FOR MAKING AND SHARPENING ROCK DRILL BITS.

The Sullivan machinery company is placing on the market a new drill-making and sharpening machine, designed on the lines of the Imperial Sharpener, for a number of years built by Mr. T. H. Proske, of Denver.

The Sullivan machine bears only a family resemblance to its Denver prototype. The new machine is larger, more heavily built, more powerful. All its working parts are much larger and more substantial and with more generous bearing surfaces. The new machine is about double the weight of the old.

The Sullivan sharpener consists of two members, one horizontal, the other vertical, both mounted on a substantial box-shaped frame. These members consist of Sullivan 2⅝-in. rock drill cylinders, with standard "lite eight" or differential air thrown valve motion. The horizontal drill or hammer is used for upsetting the steel into the shape of the bit or shank, by means of suitable steel dollies, loosely set on the end of the shank or distance piece. In this hammer, the piston is a floating one, as in a hammer drill, and delivers its blows on the upset anvil block-head of the projecting shank.

The vertical member furnishes power for shaping the wings of the bit, etc., and for drawing out and finishing the corners. This work is done by steel dies, one acting as an anvil, and the other attached to the piston rod above, as a swage or hammer. The vertical hammer is operated by a foot lever, which is ordinarily held up by a coil spring. This spring also serves to hold up a release pin, running through the lower valve bushing, and in turn holding the valve away from the lower seat, so that the piston is always held at the upper or rear end of the cylinder, by live air, when the hammer is idle. When the foot treadle is depressed, the pin drops, allowing the valve to seat, and the hammer to start.

The steel is held in position while being upset by steel gripping dies set in a heavy vise, which is operated by air power. This vise simply grips the steel, the forming being done altogether by the upsetting dolly and hammer. This vise consists of a heavy steel yoke, through each end of which runs a massive steel post or column. These posts are joined at the foot by a second yoke, into which fits the lower end of a substantial block or toggle link. The upper end of this link is pinned to a cross head block, running horizontally in guides in the frame. The cross head and link are actuated by a piston rod connected to a piston 12 in. in diameter, running in an air cylinder at the rear end of the frame. When air is admitted behind this piston, the cross-head is forced forward and the link forward and down, carrying the yoke with it, and closing the vise with tremendous force. The power provided by the air is multiplied many times just at the end of the travel, when the cross-head and link form a knuckle-like lever. With air at 100 lb. pressure, the pull thus exerted is estimated at not less than 100,000 lb. per square in.

One of the steel gripping dies is pinned into a socket in the top yoke of the vise, while the other fits a similar socket in the frame or base below.

The vise and the upsetting hammer are operated by one hand lever, the valve motion being so controlled that as the handle is depressed, the vise is closed before air is admitted to the upsetting cylinder. Further depression starts the hammer reciprocating. The vise valve rod contains a link and coil spring which holds the valve in position to keep the inlet port to the upsetting cylinder closed when the machine is idle.

In stopping the machine, the lever is raised, first shutting off air from the upsetting hammer and, when this has stopped, opening the vise.

Air enters the machine at the rear by standard pipe connections. No hose is employed, except a short length for cleaning purposes. One arm of the inlet pipe enters the valve chest of the vise or clamping cylinder, while a second supplies the vertical hammer. An outside connection leads air from the side of the clamping cylinder chest to the valve chest of the upsetting hammer.

The exhaust from this cylinder is led directly into the frame. Exhaust air is led from the clamp valve chest, by a pipe and red passages, to the vise rod guides. Whenever the vise is opened, this exhaust air escapes, effectively blowing dirt and scale out of the dies and clamp. A similar arrangement is used in the vertical member to keep the dies clean.

Bits of any form and gauge may be on this machine, on steel of any shape, solid or hollow; and shanks also may be formed to order, providing proper dollies and dies are furnished. The collared shanks on hollow steel for rotators or hand-feed hammer drills, and the lugged shanks for mounted water jet hammer drills are two forms that are made economically and rapidly.

It is an accepted fact that no improvement on or even satisfactory substitute has been found for the making and sharpening of drill bits by the hand work of a skillful blacksmith, in so far as the character of the steel is concerned. The drill sharpening machine makes bits faster and more uniformly, as to shape and gauge, than can the most expert hand-smith. But the qualities given the steel by the constant hammering of the bit on the anvil are not secured by mechanical means such as squeezing or molding, sometimes used as a substitute. Practical drillmen know that the footage drilled by a new bit is not as great as it will be after the bit has been under the blacksmith's hammer a few times. In other words, the hammering refines, toughens and aligns the structure of the steel in the direction that gives greatest resistance to wear and shock.

This is the effect secured by the Sullivan sharpener, in which all work, from first to last, is done by hammering, so that to the uniformity of gauge and perfection of shape attained in other sharpeners as well, are added the qualities of increased durability, toughness and strength.

COPPER.

Boston, June 11, 1915.

Instead of abating in any degree, the foreign demand for copper shows signs of increasing. Cabled inquiries for the metal early in the week have been followed by new demands from abroad calling for much larger tonnages than were originally sought.

The present record-breaking buying movement in copper got under way in big volume last Friday, since which time sales have crossed the 100,000,000 lb. mark according to estimates of producers booking large quantities.

PERSONAL AND GENERAL

Mr. H. C. Bellinger, of Spokane, Washington, for a number of years an operating metallurgist in British Columbia, and afterward general manager for the Great Cobar, Ltd., in New South Wales, Australia, was in San Francisco last month on his way to Nevada.

Mr. James Ashworth, of Vancouver, B.C., has been appointed by the Provincial Government, British Columbia, to make an investigation with the object of ascertaining the cause of the recent explosion in the Western Fuel Co.'s Reserve mine, near Nanaimo, Vancouver Island, B.C.

Mr. T. Walter Beam, of Denver, Colorado, is expected to again spend the field season in Similkameen district, British Columbia, as representative of the New York Syndicate No. 2 in connection with its exploration, by means of diamond drills, of a group of mineral claims situated in Camp Hedley.

From Fairbanks, Alaska, has come information to the effect that Mr. W. J. Elmendorf, of Seattle, Washington, who was for several years general manager for companies developing mining properties in Portland Canal mining division, British Columbia, has left Fairbanks for the Kantishna where, in the interests of New York capitalists, he will visit various mining properties and probably as well ascertain the availability or otherwise of the Nenana river for water-power purposes.

Mr. W. D. Greenough, manager of the Pueblo mine in Whitehorse copper camp, Southern Yukon, who went East a few weeks ago, was expected to return to the mine by the beginning of June.

Mr. Francis Glover, mine manager for the Princeton Coal and Land Company, operating a coal mine at Princeton, Similkameen, B.C., has been appointed agent for the holders of the Roany placer leases, on Tulameen river, about nine miles above the junction of that stream with the Similkameen.

Mr. Ronald Harris, formerly engaged in mining engineering in Canada, left Seattle, Washington, on April 25 for Knik, Alaska.

Mr. John Hopp has returned to Barkerville, Cariboo, B.C., after having spent the winter away from the several hydraulic placer-gold mines, owned by himself and associates and in that district.

Mr. Joseph G. S. Hudson, of the Division of Explosives, Mines Branch, Ottawa, who had been attending an inquest held at Nanaimo, B.C., on May 17, in connection with the death of some miners when the Pacific Coast Coal Co.'s South Wellington mine was flooded last February, has since been investigating the disaster that occurred on May 27 when 22 men lost their lives in an explosion at the Reserve mine, near Nanaimo.

Mr. Henry Johns, of the mining engineering firm of Keffer & Johns, of Spokane, Washington, was at Greenwood, Boundary district, about the middle of May.

Mr. Oscar Lachmund, of Greenwood, B.C., general manager for the British Columbia Copper Co., and the Canada Copper Corporation, recently investigated a mining property situated near Oroville, Washington.

Mr. Jules Labarthe, for a number of years superintendent of the lead and copper smeltery at Trail, B.C., and since then general manager for the Mason Valley Mines Co., Nevada, paid a visit to Trail last month. He is now a member of the firm of Bradley, Bruff & Labarthe, mining and structural engineers, San Francisco, California.

Mr. Lewis A. Levensaler, of the Tacoma Smelting Co., Puget Sound, Washington, was in Ashcroft mining division, British Columbia, last month, investigating a copper property.

Mr. W. H. Linney, who some years ago was connected with mining in Ontario, is now president and manager of the Dominion Silver-Lead Mines Co., which is preparing to resume development of its mine near Colville, Northeastern Washington.

Mr. I. L. Merrill, of Los Angeles, California, president of the Hedley Gold Mining Co., arrived at Hedley, Similkameen, B.C., on May 11, on one of his periodical visits to the company's gold mine and stamp mill, situated in Camp Hedley.

Mr. M. E. Purcell, of Rossland, B.C., superintendent of the Consolidated Mining and Smelting Co.'s Centre Star-War Eagle group of mines, recently left Rossland to spend a month's vacation visiting the Panama-Pacific International Exposition at San Francisco, California, and other places of interest on the Pacific Coast.

Mr. Roy Wethered, for some time with the Consolidated M. & S. Co., at its mines and concentrating mill in Ainsworth camp, is now superintendent for the United Copper Co.'s concentrating plant at Chewelah, Washington, U.S.A.

Mr. J. B. Tyrrell, Toronto, was elected president of the Geological Section of the Royal Society of Canada at its annual meeting held in Ottawa May 25-27.

Mr. J. S. DeLury is at Neuchatel, Alberta.

Mr. J. B. Tyrrell is in the Michipicoten District, examining mining properties there.

Prof. H. E. T. Haultain has been appointed arbitrator in a dispute between McCamus & McKelvie, lumbermen, and several mining companies operating at Cobalt.

Mr. C. H. Poirier has returned to Porcupine from New York.

Messrs. Jas. McEvoy, Toronto; Mr. C. H. Little, Haileybury; Walter Herd, Glace Bay, and E. D. Black, Edson, have been recommended to the Department of Militia and Defence, by a committee of the Canadian Mining Institute, to act as instructors in certain branches of mining practice to troops now in training for overseas service.

Mr. George Dunkell, head driller for the Western Pacific Co., Calgary, was struck by lightning and seriously injured on May 24.

Mr. George Watkin Evans, of Seattle, was in New York recently on professional business.

Mr. A. G. Burrows of the Ontario Bureau of Mines, is at Porcupine, gathering additional material for his geological report on the gold district.

Mr. Herbert M. Wilson, engineer in charge of the Pittsburg Experiment Station of the United States Bureau of Mines, has resigned from the Government service to become the director of a newly-formed organization to be known as the Coal Mine Insurance Association.

George O. Bradley, Charles E. Bruff and Jules Labarthe announce the opening of new offices in the Hobart Building, San Francisco, under the firm name of Bradley, Bruff & Labarthe.

NIPISSING.

Cobalt, Ont., June 10, 1915.

During the month of May, Nipissing mined ore of an estimated value of $175,522, and shipped bullion from Nipissing and Customs ore of an estimated value of $277,671. In the same period the high-grade mill treated 177 tons of ore and shipped 553,007 fine oz. of silver, while the low grade mill treated 7,016 tons. The estimate of production for the month is: High-grade, $102,324; low-grade, $73,198; total, $175,522.

SPECIAL CORRESPONDENCE

PORCUPINE AND SWASTIKA

Goodfish.—There is an excellent chance that the development which is taking place in the Goodfish Lake district may bring forth fruit in the shape of productive mines. In consequence of the great shortage of money for prospects, only the most essential work is being done; but the results to date have been quite satisfactory. Goodfish is an extension of the Kirkland Lake belt. The claims there were staked shortly after the Tough-Oakes and neighboring claims had been staked, and many of them have been held since. Little more than the assessment work has been undertaken until this year. Goodfish is partly in the township of Morissettee and not more than an hour's brisk walk over an excellent trail from Kirkland Lake. A bush road is now being built.

The Costello, in which Mr. C. A. Foster has a third interest, is the pioneer claim of the section. Some years ago it was stripped, a few test pits sunk, and it was thoroughly sampled, with the result that on the surface it gave an assay of seven to eight dollars over a width of from fifteen to twenty feet. Nothing of any importance has been attempted on it since, though it is now said that it is going to be developed.

The Martin claim adjoins it. Upon this property a shaft has been put down twenty feet, with the result that some very spectacular ore has been found. It is similar in character to that obtained in the Tough-Oakes vein, and is of good width. Much of the ore which does not show visible gold upon roasting exhibits beads of it.

The Gibson claim, at the other end of the same lake, is under option to a New York and Buffalo syndicate, for whom Mr. Frank Loring is acting. A shaft has been put down on the incline following the vein to eighty feet. At that depth there are two distinct veins of ore showing much molybdenite and some visible gold. Careful sampling indicates that four feet across the shaft an average assay will go at least sixty dollars and will often run up as high as eighty dollars. On the surface the vein was very narrow indeed.

There is no machinery in the camp at all yet, but a road is being built, and some may be taken in before the summer is much further advanced.

Tough-Oakes—Two properties are working in or near Kirkland Lake. The Tough-Oakes mill is now running at full capacity and regular clean-ups are being made. In the month of May the clean-up ran between $50,000 and $60,000. About 2,400 tons of ore was treated. It is the endeavor so to mix development ore with that stoped that a grade of twenty dollars a ton should go to the mill. At present, owing to some peculiarities of the ore, the Hardinge mill is not crushing more than eighty tons a day, while the tube mills can handle 60 tons each and the cyanide plant is capable of treating far more than is at present going to it. If it is not found practicable to tune up the Hardinge mill so that it will treat a hundred tons a day another and smaller mill will be installed. The mill is making an extraction of about 90 per cent. at present, and the tails, which are running about $1.40, are being impounded for further treatment. Several minor mechanical changes have yet to be made, and the management is confident that the extraction will be raised very considerably. In the mine all the ore is coming from the main shaft in the west drifts. Both at the 200 and the 300 ft. levels the vein has faulted and crosscuts are being run to pick it up beyond the fault. A crosscut is also being run to connect with the No. 3 shaft and to pick up the No. 6 vein.

At the Lake Shore mine, operating on a bay of Kirkland Lake, some interesting conditions have been found. The vein was followed down the shaft to 84 ft. when it dipped out. The shaft was carried down vertically. Upon crosscutting, the vein was soon picked up, but it did not give pay ore across a milling width until the contact between the porphyry and the conglomerate was reached, when the assay across 5 ft. jumped up to about sixty dollars. While the average values were not maintained at that high figure, yet as long as the vein followed the contact the ore was of good grade. To the east, under the lake, the vein has been followed for some distance and some crosscutting done. It is of good width and it is well defined and carries some gold. A diamond drill is now being operated boring a flat hole, and some small leads have already been crosscut in the porphyry. It is hoped by this work to pick up the extensions of the Wright-Hargreaves and the Teck-Hughes ore bodies which undoubtedly both run into the lake.

Porcupine Crown.—The diamond drilling and crosscutting to the south of the present workings at the Porcupine Crown has produced most satisfactory results. On the 200 and 300 ft. levels crosscuts have picked up the vein beyond the second fault and drifting is now continued in good high grade ore. On one level the drift is in good ore 60 ft. beyond the fault, in another, 40 ft. A considerable amount of exploration work was necessary before the extension of the vein was found.

On the 500 ft. level a horizontal hole was pushed to the south from the south end of the workings, with the result that the vein has been cut very much where it was anticipated it should be found. This discovery indicates that below 550 ft. or thereabouts the ore body should be continuous instead of being broken by the faults. The mill is still making a remarkable extraction. On several days last month the extraction amounted to no less than 98.41 per cent. on a $16 head. It has now been determined to treat the residues in the tailings pond before they are covered up with the waste dump, and fifty tons of it will be handled a day. These residues run a little more than three dollars per ton, so that the production from the mine will be cut down while they are being treated. On the other hand more drills will be available for development of the territory to the south, which has just been opened, and the mine will not be required to furnish a hundred tons of ore a day.

Imperial.—The steam plant of the Porcupine Imperial is now working and two drills are being operated. It is also understood that a contract for diamond drilling has been let.

McIntyre.—The new directorate of the McIntyre visited the property recently for the first time. It is understood that it has been determined to carry on a most aggressive policy of development underground, as it is considered that the prospects of the property fully warrant it.

The production from the McIntyre was considerably lower last month owing to the fact that a larger proportion of ore was taken from No. 4 shaft, where there is a considerable amount of sericite in the ore and it is difficult and slow to settle.

The construction of the Schumacher mill is finished. The work was started only on April 17th, and the whole has been finished and roofed in by June 20 by the contractors. All the machinery has been ordered, but none of it has arrived as yet.

In a crosscut from the main shaft to the McIntyre line, one of the series of veins cut with a diamond drill has been cut. It is 4 ft. wide and of a good grade of ore. It is one of a series of veins that is known to come across into the property from the McIntyre.

COBALT, GOWGANDA, SOUTH LORRAIN

Coniagas.—Drifting on the new vein found on the Coniagas mine from their new shaft in the centre of the town still continues with satisfactory results to the company. The company last week shipped three cars of concentrates to the Coniagas Reduction smelter at Thorold.

Nipissing.—Several new veins have been found by the hydraulic near Peterson Lake. These veins are narrow and the grade of ore is not high, but they are of good length and they are being developed. The pump will shortly be moved to Cart Lake, where it will be used to wash off the overburden on the conglomerate area owned by the Nipissing. A little superficial trenching was done on this area in the earlier days of the Nipissing. Underground quite a lot of drifting and crosscutting has been done from shaft 150, but veins found carried no silver of any importance. The Nipissing has about a hundred acres here which should be very well worth prospecting, as it is all conglomerate and of a good depth.

Temiskaming.—From the Temiskaming mine there has been shipped the heaviest weight of silver that has ever left the camp in the form of crude ore. The car weighed approximately 85,400 lb., contained 308,000 oz. and was valued at $152,460. The car was only valued by grab sample, but those are approximate figures.

It is not the richest car in regards to dollars and cents received from the smelter. Two years ago this fall when silver was selling at 64½ cents the McKinley-Darragh marketed a car of ore weighing 77,000 lb. containing 245,000 oz., for which they received net from the smelters $154,000. This was not as rich a car, considered from a value per ton basis, as the Temiskaming, and it is probable that the cars shipped from the Nipissing in the very early days of the camp and from the O'Brien in 1906 contained a larger percentage of silver. As regards the highest percentage of silver per ton, it is probable that the palm goes to the car shipped out of the Reeves Dobie at Gowganda, but it did not contain more than seven or eight tons.

Bullion shipments from the camp to England are scarcely less to-day than they were before the war, with the exception of the Nipissing. That company ships its bullion to agents in New York, who re-consign it to London.

NOVA SCOTIA

Dominion Coal Outputs.—The production of the Glace Bay mines for May will be roughly 440,000 tons, comparing with 405,351 in May, 1914. This is the first occasion for a year that the monthly production has exceeded that of the corresponding month in the previous year. The total output of the Glace Bay mines for the five months ending May will be 1,627 tons, comparing with 1,801,773 obtained during the corresponding period of 1914.

The output of June, 1914, was 452,270 tons, the largest single month's production ever obtained by this company from the Glace Bay collieries. It is expected that the outputs of June, 1915, will at least equal those of last June, and it will not be surprising to see them exceeded.

The production of the Springhill collieries for May will be about 31,000, slightly less than last May. The aggregate to the end of the five months, January to May, will be about 165,000 tons, or almost identical with the figures for the corresponding period of 1914.

The output from the twin collieries, Nos. 2 and 9, for May was the largest these mines have yet produced. The production of No. 2 (Phalen seam) was 76,000 tons, exceeding by three thousand tons the highest recorded figure for one month. The output of No. 9 was 40,000 tons, being within a few hundred tons of the best performance of this colliery. The mines were idle one day in the first fortnight of the month because of lack of outlet, and were again idle on Victoria Day, so that this record production was obtained in 24 working days, compared with the maximum of 27 working days. The combined production of the two seams was therefore 116,000 tons for the month, or an average of almost 5,000 tons daily. No. 2 colliery is now about fourteen years old, and it is no mean achievement to get so large an output at this date, without any notable expenditure having been made on equipment for many years past.

The "Morwenna" torpedoed.—A reminder of the actuality of the war has been given to Cape Breton in the torpedoing of the "Morwenna." This vessel was one of the "Black Diamond" Line vessels, which, owing to the temporary abandonment of the Newfoundland-Cape Breton-Montreal service by the Dominion Coal Company, was engaged in freighting steel products to Great Britain and France. Not content with torpedoing the "Morwenna," without warning, the German submarine shelled the vessel and killed one of the hands as the boats were being lowered. So far as your correspondent is aware, this is the first Canadian steamer to be destroyed by the Germans, presumably because it was the first time they had the opportunity. One nation on this side the Atlantic has solemnly stated it will hold the Imperial German Government to "strict accountability" for its submarine warfare. There is another nation in America that is already engaged in the straightening of accounts with Germany, and the Canadian people may be credited with average memories. Perhaps when this war is over it may be possible to buy a Sheffield blade in a Canadian store without the necessity of bulldozing the proprietor. It would be interesting to ask how many persons in Canada are under the impression that "Boker" cutlery is made in Sheffield. Irish linen collars may perhaps be preferred to Austrian-made collars when the little pleasantries of the Teuton are ended, and perhaps the legend "Made in Germany" may cease to flaunt itself on every article in the "Fifteen Cent Stores." Maybe underwear that is manufactured in Nova Scotia and in Ontario may be preferred by Canadians to underwear made in the purlieus of Berlin-on-the-Spree, and possibly the words "Made in Austria" may no longer appear on every high quality lead pencil used in Canadian drawing-offices. And conceivably when the smoker wishes to light his pipe in days to come he may not be requested to "zunden an den braunen Streichflachen" with matches that are made in Zanow, Pommern—otherwise Prussia. It may be remembered that it was the

Pomeranians that burned Louvain and murdered its citizens.

We shall owe something to the men who fell at Langemarck, and the Canadian women and children who went down with the "Lusitania" on that day when the German commercial traveler ceases to murder sleeping babies and to poison wells and comes to Canada with samples of his wares.

BRITISH COLUMBIA

A General Review.—On the whole, mining in British Columbia is not now adversely affected to any very considerable extent by the war in Europe, the branches of the industry that last year experienced a decided setback having in large measure recovered their equilibrium, or, where production is not normal, other influences now being mainly responsible for lack of progress. For instance, placer-gold mining was continued as usual throughout the whole of the 1914 season, and now that the 1915 season has been opened, all the larger placer-gold mines that were operating last year have commenced this year's hydraulicking or other mining. In lode-gold mining, the chief important mines on the list of producers at this time last year, but not now contributing to the production of this metal, are those of the British Columbia Copper Co., the continued suspension of which is attributable to other causes. Several lead and silver-lead mines, notably the Bluebell, in Ainsworth division, and the Standard, in Slocan, that had not earlier resumed production, owing mainly to less favorable terms obtainable from the smelting company, are again being worked and will shortly be again on the shipping list. Zinc-lead ore is being treated at the concentrator of the Silverton Mines, Ltd., owning the Hewitt-Lorna Doone group, situated a few miles from Slocan lake, and the Rambler-Cariboo and Ivanhoe mills in Central Slocan, are also turning out a silver-zinc as well as a silver-lead product. Both the Ruth and the Slocan Star concentrators, in the same neighborhood, have been prepared for a resumption of milling, and both are equipped for making the two kinds of concentrates just mentioned. Further, the Standard mill, at Silverton, has had added to its modern equipment for concentration of silver-lead-zinc ores a small experimental unit with the object of giving a trial to French's process for separation of zinc and lead, which process, as stated in an official description published in the Annual Report of the Minister of Mines for British Columbia for 1911 (pp. 163-5) "aims at the extraction and recovery of the zinc contained in ores, such as the silver-lead-zinc ores of the Slocan, leaving as a residue the silver-lead, iron, and gangue-matter, which would afterward be smelted in the same manner as a lead-ore free from zinc." The Granby Consolidated Co. is now operating its mines and smelting works in Boundary district to full ordinary capacity, thereby again contributing largely to the production of copper and, in much smaller measure, to that of lode-gold and silver. As already mentioned, the British Columbia Copper Co. is not now producing, so that its usual proportion of those metals is lacking, but it is stated it will soon again be operating. In Kootenay district, the Consolidated Co. has not yet resumed production of silver-copper ore at its Silver King group, near Nelson. On the Coast, production temporarily has been halted at the Britannia mine as a result of the destruction, on March 22, of its aerial tramway, upper terminal and other works at the mine, but preparations for resuming ore-production are being energetically carried on, so that here, too, an early return to productive operation is expected. The Granby Consolidated Co.'s comparatively large addition to the output of copper in the Coast district, is, however, more than compensating for the present loss in total quantity caused by the enforced suspension of production from the Britannia mine. As to coal mining, the position is not generally satisfactory, but to a considerable extent this is attributable to the substitution of oil for coal as fuel by railway and steamship companies. With the object of reducing the advantages fuel oil has in competition with coal in the Coast and lower mainland districts, the Dominion Government is being urged to place a sufficiently high customs duty on fuel oil as to in large measure protect the coal-mining industry; on the other hand transportation companies are also making strong representations to the Government showing that their considerable expenditures in making provision for the use of oil as fuel must also be taken into serious account in dealing with this question.

Ore Production.—The increase in total quantity of ore received at the Consolidated Mining and Smelting Co.'s works at Trail, as indicated earlier in the month, is being maintained; though it is not yet general, decreases in receipts from some parts of Kootenay district are more than compensated for by increases in those from others. The total for four weeks ended May 27 was 32,051 tons as compared with 26,583 tons for the corresponding period in 1914. The respective proportions for the two years, the figures in brackets being for May of 1914, are as follows: East Kootenay 4,145 (1,353) tons, Ainsworth 518 (1,540) tons, Slocan 407 (1,650) tons, Nelson 295 (1,609) tons, Rossland 23,729 (19,495) tons, Boundary 15 (24) tons, State of Washington 2,942 (912) tons. The considerable increase from East Kootenay was in ore from the Sullivan Group lead mine; the greater part of the decrease from Ainsworth mines was from the Bluebell, at which, however, work was resumed late in May after a suspension of operations that lasted nine months; in Slocan, similarly, the decrease was attributable chiefly to the non-production this year of one mine—in this case, the Standard—but here again, operations have quite lately been resumed; in Nelson division, too, the smaller total is accounted for by the fact that a single producer of last year—the Silver King, which then shipped 1,545 tons—has not made any output this year. The increase of amounts received from both Rossland and Washington mines is satisfactory; of the latter, there were ten shippers in May of this year as compared with but four during the same month of 1914.

AMERICAN ZINC.

According to the Boston News Bureau the American Zinc, Lead & Smelting Co. is 70 per cent. sold for the balance of this year. In other words, all but 30 per cent. of the spelter and concentrates which it will produce for the second six months has been contracted for. Were the company to avail itself of to-day's bid prices for spelter it could sell its remaining output at prices to show an average of 20 cents per lb. for the last half of the year. Such is the mad competition for supplies of spelter from manufacturers who have taken big ammunition orders and who, of course, cannot sign contracts until they are sure of their ability to get their spelter, or for that matter spelter for delivery this side of September 1, there is none, and those who have charge of selling the output available for delivery in October, November and December are at their wits' ends to know what to do—grab a certain fabulous profit or wait for more?

MARKETS

TORONTO MARKETS.

June 10, 1915—(Quotations from Canada Metal Co., Toronto)—

- Spelter, 35 cents per lb.
- Lead, 8 cents per lb.
- Tin, 45 cents per lb.
- Antimony, 40 cents per lb.
- Copper casting, 22 cents per lb.
- Electrolytic, 22 cents per lb.
- Ingot brass, yellow, 13c.; red, 15 cents per lb.

June 10, 1915—(Quotations from Elias Rogers Co., Toronto)—

- Coal, anthracite, $7.50 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

June 10, 1915—Connellsville coke (f.o.b. ovens)—

- Furnace coke, prompt, $1.50 to $1.55 per ton.
- Foundry coke, prompt, $2.00 to $2.40 per ton.

June 10, 1915—Tin, straits, 40.25 cents.

- Copper, Prime Lake, 19.50 to 19.75 cents.
- Electrolytic copper, 19.50 to 19.75 cents.
- Copper wire, 20.75 to 21.00 cents.
- Lead, 5.85 to 6.00 cents.
- Spelter, 26.00 to 27.00 cents.
- Shet zinc (f.o.b. smelter), 30.00 cents.
- Aluminum, 28.00 to 29.00 cents.
- Nickel, 45.00 to 48.00 cents.
- Platinum, soft, $40.00 per ounce.
- Platinum, hard, 10 per cent., $42.00 per ounce.
- Bismuth, $2.75 to $3.00 per pound.
- Quicksilver, $74.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
May—		
26	49¾	23 9/16
27	49⅝	23½
28	49½	23 7/16
29	49¼	23 5/16
31	..	23 5/16
June—		
1	49⅜	23⅜
2	49¼	23 5/16
3	49¼	23 5/16
4	49⅛	23¼
5	49¼	23 5/16
7	49⅜	23⅜
8	49½	23 7/16

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ontario.)

New York Curb.

	Bid.	Ask.
Alaska Gold	36.00	36.50
British Copper	.50	.87½
Braden Copper	7.37½	8.12½
California Oil	283 00	285 00
Chino Copper	47.62½	47.87½
Giroux Copper	.50	1.50
Goldfield Cons.	1.50	1.56¼
Green Can.	36.00	38.00
Granby	84.00	84.50
Inspiration Copper	32.87½	33.00
International Nickel	140.50	141.50
Miami Copper	26.50	26.62½
Nevada Copper	16.00	16.12½
Ohio Oil	136.00	138.00
Ray Cons. Copper	24.50	24.87½
Standard Oil of N. Y.	184.00	187.00
Standard Oil of N. J.	102.00	104.00
Standard Oil (old)	1315.00	.....
Standard Oil (subs.)	970 00	.....
Tonopah Mining	7.00	7.12½
Tonopah Belmont	4.43¾	4.56¼
Tonopah Merger	39.00	40.00
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex	.02½	.03
Dome Extension	.08	.08½
Dome Lake	.10	.10½
Dome Mines	14.25	14.75
Foley O'Brien	.30	.35
Hollinger	25.75	26.25
Jupiter	.09½	.10¼
McIntyre	.42	.42½
Pearl Lake	.01	.01½
Porcupine Gold	.00½	.00¾
Porcupine Imperial	.05⅝	.05¾
Porcupine Crown	.78	.80
Porcupine Vipond	.46	.46½
Porcupine Tisdale	.02	.03
Preston East Dome	.02	.02½
Rea	.10	.12
West Dome	.03¼	.03¾

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02½	.02⅝
Beaver	.32½	.34
Buffalo	.60	.90
Chambers Ferland	.16	.18
Coniagas	5.00	5.25
Crown Reserve	.80	.83
Foster	.04	.05
Gifford	.02	.02½
Gould	.00⅛	.00⅝
Great Northern	.02¼	.02½
Hargraves	.01	.01½
Hudson Bay	.....	19.50
Kerr Lake	4.55	4.75
La Rose	.49	.55
McKinley	.30	.33
Nipissing	5.65	5.75
Peterson Lake	.22½	.22¾
Right of Way	.04	.05
Silver Leaf	.02½	.03
Temiskaming	.34½	.34¾
Trethewey	.13	.15½
Wettlaufer	.03¼	.03½
Seneca Superior	1.00	1.15

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario		Quebec	British Columbia
Cohen, S. W.	Haultain, H. E. T.	Burchell, Geo. B.	Brown & Butters.
Campbell & Deyell.	Segsworth, Walter E.	Cohen, S. W.	Fowler, S. S.
Carter, W. E. H.	Smith, Alex H.	DePencier, H. P.	**FOREIGN-New York**
Ferrier, W. F.	Smith, Sydney.	Hardman, J. E.	Canadian Mining & Exploration Co., Ltd.
Forbes, D. L. H.	Maurice W. Summerhayes.	Hersey, Milton L.	Colvocoresses, Geo. M.
Gwillim, J. C.	Tyrrell, J. B.	Johnson, W. S.	Dorr, Jno. V.N.
Hassan, A. A.		Smith, W. H.	Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1913.

NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.

ONTARIO
Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.

YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.
Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N. S.

QUEBEC
Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO
Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.
Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA
Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography.
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.

YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

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The Canadian Miner's Buying Directory.

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Jones & Glassco
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Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

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Mussens, Ltd.

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Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

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Nova Scotia Steel & Coal Co.

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Mussens, Ltd.

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Canadian Explosives, Limited

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Mussens, Ltd.

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Conveyors—Belt—
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Couplings—
Dodge Mfg. Co., Ltd.
Boving & Co. of Canada, Ltd.

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Mussens, Ltd.
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Cranes—Electric—
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B. Greening Wire Co., Ltd.

Crushers—
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Peacock Bros.
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Mussens, Ltd.

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Diamond Drill Contracting Co.
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Mussens, Ltd.
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Sullivan Machinery Co.
Peacock Bros.
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Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

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Northern Canada Supply Co.
Mussens, Ltd.

Dump Cars
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Mussens, Ltd.

Drills—Electric—
Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd.

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Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

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Jeffrey Mfg. Co.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Mussens, Ltd.
Peacock Bros.

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Dodge Mfg. Co., Ltd.

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Peacock Bros.

Engines—Gas and Gasoline
Fraser & Chalmers of Canada, Limited.
Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.

Engines—Haulage—
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Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.

Engines—Oil—
Peacock Bros.
Boving & Co. of Canada, Ltd.

Engines—Crude Oil—
Boving & Co. of Canada, Ltd.

Engines—Steam—
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Mussens, Ltd.

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Mussens, Ltd.

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Mussens, Ltd.
Northern Canada Supply Co., Ltd.

Forging—
M. Beatty & Sons.
Smart-Turner Machine Co.
Peacock Bros.
Boving & Co. of Canada, Ltd.

Continued on page 23.

Canadian Miner's Buying Directory.—(Continued from page 22.)

Furnaces—Assay—
Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian H. W. Johns-Manville Co., Ltd.

Gears—
Smart-Turner Machine Co.
Northern Canada Supply Co.
Boving & Co. of Canada, Ltd.

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Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

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Boving & Co. of Canada, Ltd.
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Heaters—Feed Water—
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Mussens, Ltd.
Northern Canada Supply Co.

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Mussens, Ltd.
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Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
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Mussens, Ltd.
Northern Canada Supply Co.

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Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

Link Belt—
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—Electric—
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Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
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Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

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International Nickel Co.

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Northern Electric Co., Ltd.
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Dodge Mfg. Co., Ltd.

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Can. Laboratories.
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Orford Copper Co.
Canada Metal Co.

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Sullivan Machinery Co.

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Thos. & Wm. Smith.
Peacock Bros.

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Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Mussens, Ltd.
Northern Canada Supply Co.

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Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

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Mussens, Ltd.

Prospecting Mills and Machinery—
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Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Dodge Mfg. Co., Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith.
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Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
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Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

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Smart-Turner Machine Co.

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Fraser & Chalmers of Canada, Limited

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Dominion Bridge Co.
Mussens, Ltd.
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Mussens, Ltd.

Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
Canadian Laboratories.
C. L. Constant Co.
Ledoux & Co.
Milton Hersey Co.
Thos. Heys & Son.

Screens—
B. Greening Wire Co., Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Cross Patent Flanged Lip—
Hendrick Mfg Co.

Separators—
Smart-Turner Machine Co.
Peacock Bros.

Shafting—
Dodge Mfg. Co., Ltd.

Sheets—Genuine Manganese Bronze—
Hendrick Mfg. Co.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons.

Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Spiral Conveyors—
Dodge Mfg. Co., Ltd.

Sprockets—
Dodge Mfg. Co., Ltd.

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Hendrick Mfg. Co.

Stamp Mills—
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Peacock Bros.
Fraser & Chalmers of Canada, Limited

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Sullivan Machinery Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
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Northern Electric Co., Ltd.

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Mussens, Ltd.
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Transformers—
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Dodge Mfg. Co., Ltd.

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Fraser & Chalmers of Canada, Limited

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Peacock Bros.
Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd.

Winding Engines—
Mussens, Ltd.
Peacock Bros.
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Roessler & Hasslacher.

ALPHABETICAL INDEX TO ADVERTISERS

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